



## BLACK SEED OIL: A PROMISING ANTI-INFLAMMATORY AND ANTIOXIDANT AGENT

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**Abstract:** Black seed oil, commonly known as Kalonji seed oil, has been used for centuries in traditional medicine for its therapeutic benefits. This review article aims to summarize the current state of knowledge on the pharmacological properties, formulations, and safety aspects of Black Seed Oil. The oil's bioactive compound, particularly thymoquinone shows Anti-inflammatory effects with potential application in treating arthritis, asthma, and allergies. It also shows Antioxidant properties by reducing oxidative stress and cell damage. It is also used to treat certain type of cancer, diabetes and microbial infection, various formulations, including emulsions, capsules, and topical preparations are made which Kalonji seed oil. Overall Black seed oil offers a range of health benefits with minimal side effects.

**Keywords:** Black seeds, *Nigella sativa*, Thymoquinone, Anti-inflammatory, Antioxidant, Black seed oil

### INTRODUCTION:

Black seed which has scientific name *Nigella sativa* and known as Black cumin, love-in-a-mist, Habatut, Barakah, Sonez, Habatut, Sauda, Kalonji, Krishna, Jiraka, Sidadanah. The average height of the plant of *Nigella sativa* is about 30 to 60 cm. <sup>[1]</sup> Black seeds are used as herbal medicine since the ancient time by the civilization of South Asia and Southeast Asia and north, central and south America. <sup>[2]</sup> It is grown in the region of western Asian countries including India, Pakistan and Afghanistan and in the Mediterranean region. <sup>[3]</sup> *Nigella sativa* seeds contain yellowish Volatile oil (0.5-1.6%), Fixed oil (35.6-41.6%), Proteins (22.7%), Amino acids, Reducing sugar, Mucilage, Alkaloids, Tannins, Resins, Saponins etc. It also contains fats, fibers, minerals, and vitamins. <sup>[4]</sup> Black seeds contain anti-inflammatory, anticancer, and immunomodulatory properties. They are also used in hyperlipidemia and to stimulate body's energy and promote overall health. Thymoquinone is an active compound present in the black seeds which contains various beneficial effects in treating cancer, chronic diseases, atherosclerosis and used as an effective adjuvant in specific immunotherapy for allergic rhinitis. <sup>[5]</sup>

### Botanical description

Leaves of *Nigella sativa* are divided into two linear segments long up to 3cm. They are present in the pair on either side of the stem. Lower leaves are smaller than upper leaves. Flowers are pale blue in color and solitary long peduncles. They grow terminally on the branches. *Nigella sativa* reproduces with itself resulting in the formation of fruit which contains many white trigonal seeds. Fruit opens up automatically after getting matured and the seeds are exposed to air which leads to the color transformation of seeds from white to black thus, they are known as BLACK SEED. The seeds are triangular and have a pungent smell. They consist of a high amount of oil. <sup>[6]</sup>

### Taxonomic classification <sup>[7]</sup>

- Kingdom Plantae
- Subkingdom Tracheobionta
- Superdivision Spermatophyta
- Phylum Magnoliophyta
- Class Magnoliopsida
- Order Ranunculaceae
- Family Ranunculaceae
- Genus *Nigella*
- Species *N. sativa*.

**Chemical constituents:** The seeds of *Nigella sativa* are consisting of various chemical constituents which lead to the pharmacological activity. Various phytochemicals are present in the Black seed such as fixed oil, Protein, Alkaloids, Saponin and essential oil.

**Fixed oil:** Kalonji seeds contain fixed oil which is mainly composed of unsaturated fatty acids such as arachidonic, eicosadieonoic, linoleic, and linolenic acid and saturated fatty acids such as palmitic acid, stearic acid, and myristica acid.

**Volatile oil:** There are various chemical constituents present in the volatile oil which are responsible for pharmacological activity. Thymoquinone, Dithymoquinone, thymol, and thymohydroquinone are the main constituent present in volatile oil

**Alkaloids:** There are four alkaloids present in volatile oil such as Nigellicine, Nigellidine, Nigellimine and N-oxide of nigellimine.

**Flavonoids:** There are three flavonoids present in the black seeds such as quercetin, kaempferol 3 glucose (1-2) galactosyl (1-2) glucoside and quercetin-3(6-feruloyl glucosyl) (1-2) galactosyl (1-2) glucoside.

**Other:** Triglycoside quercetin 3-glucoside, kaempferol 3-glucoside and rutin. <sup>[8]</sup>

### Extraction method

The *Nigella sativa* seeds contain various essential oils which can be extracted by using different extraction methods such as hydro distillation (HD), dry steam distillation (SD), solvent extraction (SE-SD), and supercritical fluid extraction (SFE-SD). <sup>[9]</sup> Cold press extraction, microwave assisted, Soxhlet extraction method can also be used for the extraction purpose. <sup>[10]</sup>

### Physicochemical properties

**Stability:** Black seed oil is stable to oxidation during heat treatment. **Induction time:** Induction time of black seed extract ranges from 3.48hr to 19.6hr depending on the extraction method. **Refractive index:** The refractive index of black seed oil is 1.4714 to 1.4732 depending on the extraction method.

**Iodine value:** Iodine value is used to predict shelf life. Low iodine value indicates low unsaturated fatty acid composition, high stability, and longer shelf life. The iodine value of black seed oil is 100-128. **Melting point:** Black seed oil is liquid at room temperature due to the high amount of unsaturated fatty acid. Melting point of black seed oil is reported 1.7-3.3°C. **Viscosity:** Viscosity of black seed oil is 5.50-7.95mPa. <sup>[11]</sup>

### **Safety aspects**

Black seeds are considered as orally safe drug, and it can be used up to specific amount in food.<sup>[12]</sup> There are few cases where the excessive use of black seeds leads to abortion in the pregnant women by stimulating uterine contractions. However, it shows the inhibition of contraction of uterine in rats and guinea pigs.<sup>[13]</sup> According to few reports the topical dermatitis can be caused by the black seeds when they are applied topically.<sup>[14][15]</sup> According to the study the black seed oil has no toxic effect when it was given to mice via stomach and the powder of the *Nigella sativa* seeds does not produce any toxic effect when it is given to rabbits by gastric intubation.<sup>[16]</sup> Another study indicates the low toxicity of *Nigella sativa* oil by its higher LD<sub>50</sub> values also it indicates the safety of the wide range of therapeutic doses of fixed oils obtained from *Nigella sativa*.<sup>[17]</sup>

### **Pharmacological action**

Extract obtained from the black seeds contains various chemical constituents which are responsible for the pharmacological activities and give the therapeutic action. Thymoquinone present in the extract of *Nigella sativa* is the most potent compound responsible for the pharmacological actions.<sup>[18]</sup> Some pharmacological activities are described below;

#### **Activity**

Free radicals are the cause of generation and spreading of various chronic diseases that may leads to the overall impact on human health. Essential oil obtained from the seeds of *Nigella sativa* contains various chemical constituents which are responsible for the antioxidant activity. Thymoquinone, carvacrol, anethole and 4-terpineol are the main components showing the antioxidant effect.<sup>[19]</sup> Thymoquinone inhibits the iron dependent microsomal lipid peroxidation in a concentration dependent manner.<sup>[20]</sup>

#### **Hepatoprotective activity**

It is associated with the alteration in the levels and activities of certain enzymes such as serum glutamic-pyruvic transaminase (SGPT), serum oxaloacetic transaminase (SGOT), superoxide dismutase (SOD), catalase (CAT) and oxidant scavenger enzymes system. Thymoquinone gives protective effects against hepatotoxin tert-butyl hydroperoxide has been demonstrated using isolated rat hepatocytes.<sup>[21]</sup> The hepatoprotective activity of thymoquinone are compared with the silybin a known as hepatoprotective agent. It also gives protective effects against ischemia reperfusion injury on liver.<sup>[22]</sup>

#### **Anti-cancer activity**

On Elrich ascites carcinoma, the crude methanolic extract of the plant's seed, *Nigella sativa*, demonstrated a potent cytotoxic effect. It was discovered that *N. sativa* extracts, both alcoholic and aqueous, were effective in vitro at inactivating MCF-7 breast cancer cells whether used alone or in conjunction with H<sub>2</sub>O<sub>2</sub> as an oxidative stressor.<sup>[23]</sup> A portion of the ethanolic extract from *N. sativa* seeds were tested on mice against Lewis lung cancer cells that were subcutaneously implanted and intraperitoneally implanted as murine P388 leukemia cells. The treated mice's life duration rose by 153% when compared to the control animals that received sulphoxide treatment.<sup>[24]</sup>

#### **Anti-diabetic activity**

The usage of a plant mixture by Kuwaiti diabetics that includes *N. sativa*, gum, asafoetida, and aloe. They investigated the impact of these medications for their ability to reduce glucose levels in rats and discovered it to be successful. Additional research on the plant combination with *N. sativa* indicated that the decrease in blood glucose was brought about by the inhibition of Hepatic gluconeogenesis and the combination of plant extracts could work well as a medicinal agent for the treatment of diabetes mellitus not dependent on insulin.<sup>[25]</sup>

**Antimicrobial activity**

The extract and oil have a broad spectrum of activity against the number of microbes. The oil was more effective against the gram positive (+) than gram negative (-) organism. [26]

**Anti-inflammatory activity**

The fix oil expressed from seed of *Nigella sativa* plant is used in paralysis, back pain, skin eruptions, hemiplegia, rheumatism and inflammatory diseases on external application. The thymoquinone and crude fixed oil of *nigella sativa* both inhibit the membrane lipid peroxidation and eicosanoid generation, through the inhibition of cyclo oxygenase and 5-lipoxygenase pathways of arachidonate metabolism, thus responsible for the anti-inflammatory activity. [27]

**Gastro-intestinal system**

The *Nigella sativa* seeds are traditionally used in wide range of gastro-intestinal disorder. The liquid extract from the seeds was found to have anti-ulcer effects by reducing the amount of acid in the stomach of rats treated with acetylsalicylic acid. [28]

**Different formulation containing grape seed extract**

**Black seed oil Emulsion:** According to *Mahdi jufri*, the emulsion is made by dissolving the emulsifying agent (sucrose palmitate) in the Propylene glycol and then heated to around 40°C and then mixed with honey, preservative is added to the mixture, Black seed oil which is dissolved in alpha tocopherol is added to the mixture with constant stirring and then demineralize water is poured in the mixture and homogenized for 15 min. [29]

**Herbal hair shampoo:** For the formulation of herbal hair shampoo different part of herbs such as peel of *Citrus sinensis* roots of *Zingiber officinale*, seed of *Linum usitatissimum*, seeds of *Nigella sativa*, and seeds of *Trigonella foenum-graecum* are weighed specifically and boiled for 15 min with 500 ml of water. After cooling, it is filtered, and castor oil and vitamin E is added to the filtrate. [30]

**Herbal hand wash gel:** Carbopol is a gelling agent which is soaked in 15 ml of distilled water for overnight. Black seed oil is measured and gently heated. Then SLS dissolved in 10 ml distilled water along with glycerin is mixed in the aqueous phase with continuous stirring. Methyl paraben is dissolved in water. The swelled polymer is added to the mixture with continuous stirring to obtain homogeneous gel. Triethanolamine and rose oil is added to the mixture. [31]

**MARKETED FORMULATIONS:** There are various formulations available in the market few of them are presented in the table below:

NO	Product name	Company name	Use
1	Kalonji herbal face pack	DR. AQSA'S	For radiant & glowing skin
2	Kalonji and activated charcoal nourishing soap with essential oil	KAIRA	For deep cleansing of skin and reduce acne.
3	Black seed, Senna and Costus root Hair oil	Kares by Health crew	To prevent hair-fall
4	Kalonji Face wash	Hakim Suleman's	To remove Impurities, dead skin, and excess oil
5	Kalonji Ayurvedic capsule	Origin ayurveda	Daily supplement for the body to make it strong from within.
6	PREMIUM KALONJI BLACK SEED TABLET	Nature sure	Boost the immunity stamina and energy
7	Kalonji oil	Zero blend	To provide antioxidant, anti-inflammatory, anti-viral, anti-microbial and other health benefits.

8	Black seed & honey COUGH SYRUP	KARE & HOPE	To relieve the cough
9	Kalonji Fairness Cream	Dehlvi Remedies	Nourishes Skin and maintain the skin radiance
10	Kalonji herbal tea	GREEN VALLEY	To provide anti-oxidant effect to prevent many diseases.

[TABLE 1] – Marketed formulations containing Black seed extract

## CONCLUSION

The cumulative evidence suggests that *Nigella sativa* oil, commonly referred as Black Seed Oil, possesses a diverse array of pharmacological properties, including anti-inflammatory, antioxidant, anti-neoplastic, anti-diabetic, and antimicrobial activities. The oil's bioactive compounds, particularly thymoquinone, have been identified as primary contributors to its therapeutic efficacy. Various formulations, including emulsions, capsules, and topical preparations, have been developed to optimize its delivery and efficacy. While Black Seed Oil is generally considered safe, with a low toxicity profile, caution is advised in cases of excessive use, particularly during pregnancy and lactation. Thus, Black seed extract is a natural and sustainable approach to promote overall health and well-being with the wide range of therapeutic applications.

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