Review Article

Thymoquinone: A Natural Remedy For Treatment Of Various Diseases: A Review


Author's affiliation
1. Senior Lecturer, Department of Periodontology, SDDHC, Panchkula.
2. Professor and Head, Department of Periodontology, MMCDSR, Mullana.
3. Professor, Department of Periodontology, MMCDSR, Mullana.

Corresponding author
Dr Harsh Kapil,
Senior Lecturer, Department of Periodontology, SDDHC, Panchkula.
E-mail- harshkapil@gmail.com

Abstract
Thymoquinone (TQ) (2-isopropyl-5-methyl-1, 4-benzoquinone), the main constituent of the volatile oil of Nigella sativa seeds, has a range of pharmacologic properties, including antihistaminic, antibacterial, antihypertensive, hypoglycemic, anti-inflammatory and immunopotentiating actions; the antioxidant effect of thymoquinone is considered to be one of its most significant properties. It has been reported that thymoquinone induces an antioxidant response through the scavenging capability of various free radicals, with its scavenging power being as effective against superoxide anions as superoxide dismutase.

Thymoquinone has also been argued to have anti-inflammatory potential through membrane lipid peroxidation, via eicosanoids. In light of this data considering anti-inflammatory and antioxidant properties and the capability of significantly inhibiting the expression of proinflammatory cytokines, thymoquinone may be thought to play a significant role in preventing the initiation and progression of periodontitis.

Key words: Thymoquinone, Anti-inflammatory, Anti-bacterial, Periodontitis.

Introduction
Nigella sativa L (NS) is the small size shrub belonging to family Ranunculaceae with having tapering green leaves and rosaceous white and purplish flowers.[1] According to Muslims, prophet Muhammad said that “Use the black seed, which is a healing for all diseases except 'As-Sam' and 'As-Sam' is death”. [2] Its ripe fruit contains tiny black seeds called “Al-Habba Al-Sauda” and “Al-Habba Al-Barakah” in Arabic and black seed, black cumin, or black caraway in English. Its seeds contain more than 30% of fixed oil and 0.4-0.45 % wt/vol of volatile oil which has 18.4-24% Thymoquinone (TQ) and 46% of monoterpenes such as p-cymene and α-piene.[1]

N. sativa seeds are frequently used as medicine in the Middle East and some Asian countries (Unani, Ayurveda, Chinese and Arabic Medicines) for the promotion of good health and the treatment of many...
disorders including fever, the common cold, headache, asthma, rheumatic diseases, microbial infections, to expel worms from the intestines and as “Sartan” (cancer). In addition, it is used as a flavoring agent for bread and pickles.\textsuperscript{[3]}

A large number of in vitro and in vivo studies have been conducted on laboratory animals and humans in order to investigate the pharmacological properties of Thymoquinone like immunostimulation, anti-inflammatory, hypoglycemic, antihypertensive, antiasthmatic, antimicrobial, antiparasitic, antioxidant as well as anticancer properties. It has been used in periodontal research and investigators have got very encouraging results.\textsuperscript{[4]}

**Structure of Thymoquinone:**

Thymoquinone is 2-isopropyl-5-methyl-p-benzoquinone (Fig:1). Two stable conformations with C1 (trans) and Cs (cis) symmetries are identified (Fig. 2). In the trans conformations the C(1)C(2)C(8)C(9,10) dihedral angles are approximately $-75^\circ$, while the C(1)C(2)C(8)C(9,10) dihedral angle has a cis value of approximately $63^\circ$.

*Figure 1: Thymoquinone (TQ) structure (2-isopropyl-5-methyl-p-benzoquinone).*

*Fig. 2. The calculated molecular structure for thymoquinone.*
The structural results show that cis conformation is more stable than trans confirmation.\[5\]

USES:-

1 Anticancer Effect
The first report of anticancer activity of Thymoquinone was noted against Ehrlich's ascites carcinoma, Dalton's lymphoma ascites and sarcoma-180 cells.\[6\]
Later, thymoquinone was reported to inhibit human tumor cell lines resistant to doxorubicin and etoposide.\[7\]
Thymoquinone (0.01% in drinking water), administered one week before, during and after treatment with benzo-pyrene (BP) has shown to reduce the incidence and multiplicity of BP-induced forestomach tumor.\[8\]
In male Swiss albino mice, thymoquinone (0.01% in drinking water) administered one week before, during and after 20-methylcholanthrene treatment, significantly inhibit the fibrosarcoma tumor incidence.\[9\]
Thymoquinone has chemotherapeutic effects on SW-626 colon cancer cells.\[10\]
Thymoquinone showed anti-cancer activity against hepatocellular carcinoma by the inhibition of HepG2 cells in a dose-dependent manner.\[11,12\] It inhibits the proliferation of a panel of human cancer cell lines (Caco-2, HCT-116, LoVo, DLD-1 and HT-29), with no cytotoxicity to normal human intestinal cells (FHs74Int).\[13\]

2 Effect on Alkaline Phosphatase (ALP)
Thymoquinone reduces the level of ALP when given interaperitoneally.\[14\]

3 Antibacterial activity
Thymoquinone has antibacterial activity against Escherichia coli, Pseudomonas aeruginosa, Shigella flexneri, Salmonella Typhimurium, Salmonella Enteritidis and Staphylococcus aureus.\[15,16\]
It also inhibits Pseudomonas aeroginosa,\[17\] Klebsiella pneumonia, Proteus mirabilis,\[18\] Staphylococcus epidermidis.\[19\]

4 Antidepressant activity
It can prevent Lipopolysaccharide (LPS) induced depression like behavior in rats.\[20\]

5 Antifungal activity
It is active in preventing the growth of Aspergillus niger.\[21\]

6 Anti-inflammatory effect
TQ reduces secondary reaction to Freund's adjuvant. There was reduction in the mean values of both polyarthritis index and pain response score in rats. Significant reduction in IL-6, LTB4, MMP-9 in the serum of treated groups was observed.\[22\] It helps in reduction of MCP-1, TNF-α, interleukin (IL)-1β and Cox-2.\[23,24\]

7. Anti-oxidative effect
TQ is rich source of phytochemicals due to which it shows anti-oxidative properties.\[25,26\]

8. Effect on blood glucose level
Oral ingestion helps in reduction of level of blood glucose in humans.\[27\]
9. **Gastroprotective effect**

TQ helps in protection of gastric mucosa against the injurious effect of absolute alcohol and promote ulcer healing.\(^{[28]}\)

10. **Osteogenesis**

It helps in new bone formation and increase in number of blood capillaries.\(^{[29]}\)

11. **Anti-epileptic effects in children with refractory seizures**

There reduction of frequency of seizures in children which consumed TQ with dose of 1 mg/kg.\(^{[30]}\)

12. **Effect on periodontitis**

Oral administration of Thymoquinone diminishes alveolar bone resorption in a rat periodontitis model when administered by gastric feeding.\(^{[31]}\)

In one study Chips made up from thymoquinone and chitosan were used. The results indicated significant improvement in plaque index and bleeding upon probing and a reduction in periodontal pockets from baseline with gain in clinical attachment levels.\(^{[32]}\)

13. **Effect on acute respiratory distress syndrome**

Thymoquinone increases the ratio of arterial oxygen to the fraction of inspired oxygen (PO2/FiO2). Thymoquinone improve oxygenation while both thymoquinone and steroids given together protect lung tissue from hazardous effects of human gastric juice (pH 1.2) histopathologically.\(^{[33]}\)

---

**Conclusion**

In the various studies thymoquinone has shown the significant results. Further studies are required to study the effect of thymoquinone on periodontitis and on humans.

**References**


Competing interest / Conflict of interest The author(s) have no competing interests for financial support, publication of this research, patents and royalties through this collaborative research. All authors were equally involved in discussed research work. There is no financial conflict with the subject matter discussed in the manuscript.

Source of support: NIL

Copyright © 2014 JPMCP. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.