Antimicrobial activity of aqueous, ethanolic, methanolic, cyclohexanic extracts and essential oil of Nigella sativa seeds

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ABSTRACT

Most of the bacterial pathogens are resistant to existing synthetic antibacterial agents demanding an increasing effort to seek effective phytochemicals as antibacterial agents against such pathogens. Nigella sativa L. (black cumin) seeds play an important role in folk medicine and some of its major constituents are reported to be pharmacologically active. In this present work, Nigella sativa seed extracts were obtained using maceration extraction by various solvents (water, ethanol, methanol, and cyclohexan). The antibacterial and antifungal effects of different extracts and essential oil of seeds were investigated by the agar diffusion method against two gram positive (Bacillus subtilis CIP52.62, Staphylococcus aureus CIP4.83) and three gram negative strains of bacteria (Escherichia coli CIP53.126, Pseudomonas aeruginosa CIP82.118, Salmonella abony CIP80.39) and one strain of fungi (Candida albicans CIP48.72). All the extracts and essential oil showed varying degree of inhibition.

Keywords: Nigella sativa, Black cumin, antibacterial activity, antifungal activity.

INTRODUCTION

The problem of microbial resistance and degenerative diseases are growing and the outlook for the use of synthetic drugs without adverse effects in the future is still uncertain. Synthetic drugs also block receptor sites and hence attempts are being made to control the use of synthetic drugs and develop new drugs from natural resources like medicinal plants. Medicinal plants are important therapeutic aids for various ailments and the use of those that are native to Morocco in various traditional system of medicine are awe inspiring.

Nigella sativa (N. sativa) seed, called as ‘Black Seed’ in English language, ‘Al-Abba Al-Sauda’ or ‘Al-Abba Al-Barakah’ in Arabic and ‘Kalvanji’ in Urdu and some local languages in the Indian Subcontinent, is well known in the Middle East, Middle Asia and Far East as a natural remedy for many ailments and as a flavouring agent in bread and prickles. An authentic saying of the Prophet Muhammad (Peace Be Upon Him) about black seed is also quoted in Al-Bukhari1: Abu Huraira (Allah be pleased from him) narrated that Allah’s Apostle (peace be upon him) said “Use the black seed, which is a healing for all diseases except ‘As-Sam’ and As-Sam is Death [1].

Different pharmacological effects such as isulinotropic[2], hypoglycemic [3], anticancer [4,5], antinoceptive, anti-inflammatory[3,6,7], hepatoprotective[8], neuroprotective[9], antihistamine, antiucler [10] and bronchodilator [11] activities have been reported for this plant. Black cumin has been traditionally used in the Arabian countries, Indian continent and Europe for culinary and medicinal purposes as a natural remedy for a number of illnesses and conditions that include asthma, hypertension, diabetes, inflammation, cough, bronchitis, headache, eczema, fever, dizziness and influenza. The seeds or its oil are used as a carminative, diuretic, lactagogue and vermifuge[12].

N. sativa seeds contain 36%–38% fixed oils, proteins, alkaloids, saponin and 0.4%–2.5% essential oil. The fixed oil is composed mainly of unsaturated fatty acids. The essential oil was analyzed using GC-MS. Many components were characterized, but the major ones were thymoquinone (27.8%–57.0%), p-cymene (7.1%–15.5%), carvacrol
Preparation of plant sample
The Nigella sativa seeds were purchased from a local herbal shop in Morocco. The seeds were dried at 40°C overnight and were ground to powder in a grinder.

Preparation of different extracts:
30 g of the dried black cumin seed powder was taken in a 500 ml conical flask and 300 ml of different solvents (water, ethanol, methanol, cyclohexan) was added to the powder, which was kept at room temperature for 72 h in a dark place. The suspensions were filtrated through a sterile filter paper (Whatman-1) and the filtrate was centrifuged at 4000 rpm for 15 min. The final concentration of different extracts was fixed at 100 mg/ml.

Antibacterial test
The results of the antibacterial activity of the investigated extracts and essential oil are shown in Tables 1. These results suggest that the aqueous extract did not show any activity against E. coli, but against S. aureus and B. subtilis water extract showed higher inhibition zones. Essential oil gave higher inhibition zone against S. aureus, B. subtilis and C. albicans, but against S. abony, P. aeruginosa and E. coli showed no inhibition. Against fungal strain i.e. C. albicans, aqueous, methanolic and cyclohexanic extracts did not show any inhibition.

Table 1. Antimicrobial activity of aqueous, ethanolic, methanolic and cyclohexanic extracts and essential oil

<table>
<thead>
<tr>
<th>Test</th>
<th>E. Coli</th>
<th>S. aureus</th>
<th>P. aeruginosa</th>
<th>B. subtilis</th>
<th>S. abony</th>
<th>C. albicans</th>
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<tbody>
<tr>
<td>Aqueous extract</td>
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<td>Ethanol extract</td>
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<tr>
<td>Methanol extract</td>
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<tr>
<td>Cyclohexane extract</td>
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<td>Essential oil</td>
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</tbody>
</table>

--: No inhibition zone.
++: Presence of inhibition zone.

Due to the increased resistance of microorganisms against the currently used antibiotics and the high cost of production of synthetic drugs, pharmaceutical companies are now searching for alternatives. Medicinal plants could be one approach because most of them are safe with little side effects, if any, are of low cost and affect a wide range...
of antibiotic resistant microorganisms[20]. The present findings demonstrated that the plant material has been blessed with many of the natural phytoconstituents. These phytoconstituents as well as plant extracts are responsible for antimicrobial activity.

CONCLUSION

Based on the results obtained in this study, it may be concluded that plant extracts of *N. sativa* have a stronger and broader spectrum of antimicrobial activity against a number of food borne bacteria and the extracts may be used to discover bioactive natural products that may serve as basic source for the development of new antimicrobial compounds to overcome the problem of increasing resistance to known traditional antibiotics.

REFERENCES