

Anti-microbial effect of *Nigella sativa* seed extract against staphylococcal skin Infection

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Abstract

Background: The development of microbial resistance to the existing anti-microbial agents has become a real challenge and a serious problem facing patients suffering from skin infections. Seeds of *Nigella sativa* have been used for a long time in folk medicine for the treatment of skin infections. Production of new potent agents is urgently needed, especially for hospitals and health care centers. This study is designed to explore anti-microbial effect of extract from the *Nigella sativa* seeds against skin pustules infection.

Methods: The in vivo anti-microbial effect of the *Nigella sativa* seeds extract at a concentration of 33% on pustules staphylococcal Skin Infections was assessed and compared with standard drug mupirocin on 40 neonates. All neonates were divided and examined into two experimental and control groups randomly. Recovery times were compared between two groups.

Results: The mean of recovery time in experimental group was 75/1 with SD= ± 12, and the mean of recovery time in control group was 69/4 with SD = ± 8/7. There was no significant difference in recovery time between two groups (p value = 0/131).

Conclusion: In clinical practice, the agent of *Nigella Sativa* recovered as pustular from tissues of all patients. While the extract was as nearly effective as the standard drug, mupirocin, no side effect was observed.

Keywords: *Nigella sativa*, Saphylococcal skin infection, Neonate.

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Introduction

S. aureus is the most common cause of pyogenic infection of skin and soft tissue; causing impetigo, cellulitis, abscess, omphalitis. These infections may lead to serious local and systemic complications. Most neonates are colonized within the first week of life with *S. aureus*. Mupirocin is a bactericidal ointment used against localized infection (1). However the developing microbial resistance to the existing anti-microbial agents has become a serious problem. Resistance to Mupirocin has been reported in many infectious incidences (1-2). Therefore, production of new potent agents is urgently needed, especially for

hospitals and health centers. It is well known that Seeds of *Nigella sativa* have been used for centuries as a traditional medicine for the treatment of various diseases, including skin infections (2-3).

Previous studies have shown the anti-microbial effects of *N. sativa* seeds against different pathogenic microbes. The essential oil of the seeds have also dose-dependent anti-bacterial effects on gram-positive (*S. aureus*) and gram-negative (*E. coli*) bacteria (4). The fixed oil had more potent anti-bacterial effect against gram-positive than gram-negative bacteria (5).

The in vivo anti-microbial effect of the aqueous extract of *N. sativa* seeds was also

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Table 1. Neonatal age in two groups of Nigella (GROUP 1) and Mupirocin (GROUP 2)

| | | | Mean | Standard Deviation | Minimum | Maximum | p value |
|-------|---|----------|------|--------------------|---------|---------|---------|
| GROUP | 1 | Age(day) | 8,45 | 1,15 | 7 | 11 | 0.875 |
| GROUP | 2 | Age(day) | 8,50 | 0,83 | 7 | 10 | |

investigated in animals. Most studies on the anti-microbial potential of plant extracts, active ingredients and/or chemical drugs have been tested on experimental animals (2).

The purpose of the present study was to examine the anti-microbial effect of *N. sativa* oil extract against patients with skin infections and to explore the effectiveness of extract on the clearance of cutaneous staphylococcal infection in neonates.

Methods

A clinical trial study was designed and conducted on 40 icteric newborns with pustular infection, with no other diseases, 23 males, and 17 females, aged between 6-11 days.

Inclusion criteria: all included cases were healthy term neonates without fever and sepsis, or systemic involvement. They were hospitalized for indirect hyper bilirubinemia. They had less than 11 pustules on neck, around the umbilicus, the inguinal or auxiliary but not on the face. During this course oral antibiotics or disinfectants were not used.

Selection of *Nigella sativa* (NS): *N. sativa* were purchased from an herbal shop in Isfahan, Iran. Then Formulation of *N. sativa* was prepared by 33% crude extract of *N. sativa* under cold pressure in department of pharmacology. The reference number and place of deposition of a voucher specimen of the plant material was PMP 708 from Faculty of Traditional Iranian Medicine, Tehran University of Medical Sciences, Iran.

Because this was the first study in humans especially neonates, for prevention of any reaction, the concentration of active component (*Nigella*) was low (33%) (2).

In clinical studies a pediatrician visited

neonates on admission and clinical diagnosis of purulent pustule was confirmed. She also visited all neonates three times a day and but no treatment was performed on neonates. Informed consent obtained from each patient parents included in the study and the study protocol conformed to the ethical guidelines of the 1975 Declaration of Helsinki as reflected in a priori approval by the shahed university research committee.

Microbiologic sampling with a sterile swab was done on each child with Infections. Formulation of *Nigella Sativa* was used topically for twenty infants in the experimental group and Mupirocin for twenty infants in the control group. Two groups were selected by simple random technique. In experimental group a drop of black seed extract was used topically three times daily on the skin lesions for 4 days. In control group a topical Mupirocin ointment was used three times daily on the skin lesions for 4 days. Clinical results analyzed and a questionnaire was completed each day. Treatment in both groups was identical. Recovery identified by pediatric examination was; dry pustules with no pus or discharge. Pediatrician visited all neonates three times a day for further evaluation (Table 3).

The recovery times were recorded according to hour. The mean of recovery times between the two groups were compared (Table 3).

Statistical analysis Data were presented as means, and SD. Comparisons between groups were performed by using T-test, fisher exact test on a statistical software package (SPSS). Differences between the groups considered significant, when p-value was less than 0.05.

Results

To detect effect of *Nigella* on cutaneous staphylococcal infection we compared *Nigella* with mupirocin on cutaneous staphylococcal infection. Neonatal weights were 2/9-3/5 kg with ages of 6- 11 days. Statistical information of study and control groups is seen in Table 1. There was no significant difference in age between two groups.

Types of bacteria isolated were seen in two groups are presented in Table 2.

Antimicrobial effect of extract of *Nigella* with mupirocin was compared through recovery time (Table 3). The mean of recovery time in experimental group was 75/1 with SD= \pm 12, and mean of recovery time in control group was 69/4 with SD= \pm 8/7. There was no significant difference in recovery time between two groups. $p = 0/69$.

Discussion

This study explored the effect of black seed products on the *Staphylococcus aureus* and *Staphylococcus epidermidis* populations in neonates with skin pustules. Bacterial samples were collected from infants who were hospitalized. This study was evaluated based on comparing the recovery time. There was no significant difference in recovery time between two groups.

Clinical study on the same field of black seed on the *Staphylococcus* infection in human are not found and the effect of this

plant are found only on laboratory animals. In a study conducted on rat by Maryam, the extracts shown to have significant inhibitory effect against gram-positive bacteria. However, the extract revealed an equal effect with the standard drug, on the clearance of staphylococcal ATCC 29923 infection in vitro (2).

Other study done by Shahidi Benjar et al also investigated Black seed products indicated a good effect on the standard *Staphylococcus aureus* (6).

In a study conducted by Niakan et al, the antimicrobial effect of oil extract of black seed against two common *Staphylococcus aureus* in laboratory was studied. They concluded that the anti-microbial effect of NS oil extract is comparable with antibiotics such as Ceftazidime, Cefaclor, Cefamandole, Cefuroxime. They recommend experimental use of NS. to control *Staphylococcus aureus* infection (7).

G. Fico studied Antimicrobial activity of crude extracts, fractions and the essential oil. The antimicrobial screening was carried out against, *Staphylococcus aureus* (ATCC29213) and *Staphylococcus epidermidis* (ATCC12228), for the essential oil. The essential oil showed antibacterial activity against *Bacillus cereus* and *Staphylococcus aureus* (Gram positive bacteria) (8).

Zuridah and colleges investigated in vitro antibacterial effects of seed extracts on standard gram positive and negative bacte-

Table 2. Various bacteria in two groups of *Nigella* (GROUP 1) and Mupirocin (GROUP 2)

| GROUP | 1 | Count | Bacteria | |
|-------|---|-------|----------|-------------|
| | | | S aureus | S epidermis |
| | | | 13 | 7 |
| | | | 65.0% | 35.0% |
| | 2 | Count | 15 | 5 |
| | | | 75.0% | 25.0% |
| Total | | Count | 28 | 12 |
| | | | | 30.0% |

Table 3. Recovery time in two groups of *Nigella* (GROUP 1) and Mupirocin (GROUP 2)

| GROUP | 1 | Recovery time (hr) | Mean | Standard Deviation | p value |
|-------|---|--------------------|------|--------------------|---------|
| GROUP | 1 | Recovery time (hr) | 75/1 | 12 | 0/69 |
| GROUP | 2 | Recovery time (hr) | 69/4 | 8/7 | |

rial strains. The best result was seen on *S. aureus* (9).

Mashhadian studied the antibacterial and antifungal effects of extracts of the seeds against common and hospital strains of *Candida albicans*, coagulase-positive *Staphylococcus aureus* and *Pseudomonas aeruginosa* and compared them with standard drugs such as clotrimazole, cloxacillin and gentamicin. Their results showed that NS extracts produce antimicrobial activity against a broad range of microbes and especially on multiple antibiotic resistant bacteria (4).

M T Salman showed that NS seed oil possesses antimicrobial activity against several multidrug resistant pathogenic bacteria in vitro and may be used topically in susceptible cases. The oil showed pronounced dose dependant antibacterial activity and being more effective against gram positive *Staphylococcus aureus*, *S. epidermidis* than gram negative bacteria (5).

Conclusion

This study indicated that the product of this plant in the treatment of localized infection is almost similar to mupirocin. Our results are in agreement with others who showed that NS extracts produce antimicrobial activity against staphylococcal infections. Therefore; further studies should be followed with better formula to evaluate the drug.

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