# EFFECT OF ESSENTIAL OIL OF *Carum carvi* ON GROWTH INHIBITION OF PATHOGENIC BACTERIA

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## ABSTRACT

The antimicrobial activities of the essential oils of Iranian caraway "*Carum carvi* " were investigated against *Escherichia coli* ATCC 25922, *Klebsiella pneumonia* ATCC 13883, *Proteus vulgaris* ATCC 13315, and *Pseudomonas aeruginosa* ATCC 27853. The antimicrobial activities of the essential oils were evaluated by disc diffusion method. The results showed that the essential oil of *Carum carvi* inhibited the growth of *E. coli* and *K. pneumonia*. Furthermore, the study suggests that these essential oils can be used as preservatives in foods.

**KEYWORDS:** *Carum carvi* , Antibacterial activity , *Escherichia coli* , *Proteus vulgaris*, *Klebsiella pneumoniae* , *Pseudomonas aeruginosa* , Essential oils

## 1. INTRODUCTION

The growing interest in the substitution of traditional food preservatives, both antimicrobials activities and antioxidants, by natural ones has fostered research on screening of plant materials in order to identify new compounds. It has been known since ancient times that medicinal, aromatic and spice plants and their essential oils (active substances) have varying degrees of anti microbial activity [2][5,6][12,13][19-24][26,27]. The plants contain numerous biologically active compounds, many of which have been shown to have anti microbial properties [8]. The major antimicrobial components of these plants and their essential oils are, for example, eugenol in cloves, allicin in garlic, cinnamic aldehyde and eugenol in cinnamon, carvacrol and thymol in oregano and thyme, and vanillin in vanilla beans [19,25]. Furthermore, essential oils of many aromatic plants have been shown to possess antimicrobial activities [7,10]. Essential oils of basil, bay, clove, thyme and rosemary was reported to have bactericidal activities against *Leisteria monocytogenesis* and other pathogens [15,17]. Incidences of foodborne illnesses are still a major problem, even in developed countries. In fact, food poisoning is still a threat for both consumers and the food industry despite the use of preserving processes. Meanwhile, consumers are concerned about the safety of foods containing preservatives. Therefore, there has been a growing interest in new and effective techniques to reduce cases of foodborne illnesses. There is considerable interest in the possible use of these compounds as food preservatives, to delay the onset of food spoilage or to prevent the growth of foodborne pathogens.

The aim of the present study was to evaluate the antibacterial activity of medicinal plant essential oil of *Carum carvi* against common pathogens.

## 2. MATERIALS AND METHODS

### 2.1 Extraction of essential oil

The plant investigated in this study is *Carum carvi* (caraway) from umbelliferous family. Caraway is a member of the group of aromatic plants characterized by carminative properties, like anise, cumin, dill

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and fennel. It is a biennial, with smooth, furrowed stems growing 1 1/2 to 2 feet high, hearing finely cut leaves, and umbels of white flowers which blossom in June. The fruits (seeds) and the oil extracted from the fruits are as a medicinal properties, flavouring in cookery, confectionery and liqueurs. The seeds contain 4-7 % of essential (volatile) oil. The chief constituent of the oil is a hydrocarbon termed Carvene and an oxygenated oil Carvol. Both fruit and oil possess aromatic, stimulant and carminative properties [28]. The characteristics of the plant are in Table 1. The air dried and crushed seeds of *Carum carvi* were extracted by hydrodistillation in a Clevenger-type apparatus to obtain essential oil. The plant material was placed in water and heated to boil. The essential oil was condensed, collected in a receiver flask, and separated from water by separator container. Then the essential oil was used in the formula as a main material. The contents of essential oil components of *Carum carvi* are shown in Table 2.

Table 1. Scientific characteristics of the plant that used in this experiments.

| Name | Botanical name | Family | Part used for essential oil extraction |
|---|---|---|---|
| Black Caraway | *Carum carvi* | Apiaceae | Fruits (Seeds) |

Table 2. The approximate content of essential oil of *Carum carvi* seeds ( GC Varian with capillary column )

| | Componants | % |
|---|---|---|
| 1 | Alpha Pinen | 0.19 |
| 2 | Beta Pinen | 0.7 |
| 3 | Beta Phelandrene | 4.5 |
| 4 | Para Cimen | 3 |
| 5 | Gama Terpinen | 10 |
| 6 | Cumin Aldehyde | 20 |
| 7 | Cumin Alcohol | 50 |

### 2.2 Microorganisms

The four bacterial strains, *Escherichia coli* ATCC 25922, *Klebsiella pneumonia* ATCC 13883, *Proteus vulgaris* ATCC 13315, and *Pseudomonas aeruginosa* ATCC 27853 were used as test microorganisms in this experiment. The bacteria were incubated on a nutrient agar slant (Stationary culture) for 48 h at 37 °C followed by inoculation in Mueller Hinton Agar medium. The bacteria were supplied by the Depart ment of Microbiology, Medical Science university., Mashhad, Iran.

### 2.3 Antibacterial assay

Antimicrobial activity was demonstrated using a modification of the method originally described by Kirby-Bauer which is widely used for the antibacterial susceptibility testing [1]. A loopful of bacteria was taken from the stock culture added in 1 ml of brain heart infusion broth (BHI) and incubated at 35 °C. Final cell concentration was $10^6$-$10^7$ CFU/ml. One mililiter of this inoculum was added to each plate containing nutrient agar. All the tests were done by placing striles paper discs on the Mueller Hinton Agar surface previously inoculated with tested microorganisms with various concentrations. Fifty microliter of essential oil at each concentration were added on a paper disc. Distilled water at a concentration of 50 µl/disc was also added as a negative control. Plates were incubated at 37°C for 24 h to observe formation of inhibition zones around the disc.

## 3. RESULTS AND DISCUSSION

The results of antimicrobial effect of essential oil against tested bacteria are shown in Table 3. Essential oil of *Carum carvi* were ineffective against, *Proteus vulgaris* and *Psedomonas aeurginosa*. The results showed that the essential oil of *Carum carvi* was effective in controlling of *Klebsiella pneumonia*. The investigations of Valero and Salmeron [25] showed that the essential oil of cinnamon, oregano and

thyme were most effective on controlling of *B. cereus*[25]. Essawi and Srour [11] reported that *Salvia officinalis, Teucrium polium, Majorana syriaca, Thymus origanium, Thymus vulgaris, Commiphora opobalsamum Foeniculum vulgare*, and *Rosmarinus officinalis* exhibited an antibacterial effect against some of gram-positive and gram-negative bacteria[11]. It has been indicated that the antibacterial activity of some medicinal and aromatic plants are due to different chemical agents in the extracts, including essential oils (specially thymol), flavonoids and triterpenoids and other compounds of phenolic nature or free hydroxyl group, which are classified as active antimicrobial compounds [11,18]. The growth of *Escherichia coli* in comparison of *Klebsiella pneumoniae* was not inhibited by the essential oil, but *Pseudomonas aerginosa* did not have any reaction to the essential oil. Camporese *et al.* [4] reported that various concentrations of the plant extracts showed activity to some extent against *Escherichia coli* and *Pseudomonas aeruginosa*, while *Aristolochia trilobata* leaves and bark *Syngonium podophyllum* leaves and bark were also active against *Staphylococcus aureus* [4]. A number recent studys demonstrated an antibacterial activity of rosmarinic acid against *E. coli* and *S. aureus* [14]. Sagdic *et al.*[19] reported that among extracts of seven spices, thyme and oregano showed higher activity than cloves, garlic, and vanilla beans on the growth of *Escherichia coli* 0157:H7 [19].Natural substances from plants (specially, medicinal, aromatic and spice plants) have applications in controlling pathogens in foods [3,9]. Since the medicinal plants studied appear to have a broad anti microbial activity spectrum, they could be useful in antiseptic and disinfectant formulations as well as in chemotherapy [16].

## 4. CONCLUSION

Furthermore, beside the confirmation of the popular uses of medicinal plants, the obtained results demonstrate that these herbal drugs could represent a new source of antimicrobial agents, less expensive than the imported drugs (4).

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