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ANTIBACTERIAL ACTIVITY OF SOME ESSENTIAL OILS AGAINST *STAPHYLOCOCCUS AUREUS* AND *E. COLI*

Khaldoon Obad[1], Khaled S. Ali[1]*, Abdulla M. Lakal[1], K. S. Bekshokov[2], M.S. Saidov[2]

[1]Department of Biology, University of Aden, Yemen.

[2]Dagestan Medical Academy, Dagestan, Russia.

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***Correspondence for Author**
Dr. Khaled S. Ali
Department of Biology,
University of Aden,
Yemen.

ABSTRACT

This study was conducted to determine the antimicrobial activity of some essential oils (*Piper nigrum*, *Ocimum basilicum*, *Zingiber officinale* and *Cinnamum zeylanicum*) against *Staphylococcus aureus* and *E. coli* using agar diffusion assay. All essential oils exhibited better antibacterial activity against *Staphylococcus aureus* than *E. coli*, except *Cinnamum zeylanicum* was active to both bacteria. The Cinnamon essential oil showed maximum activity against *staphylococcus aureus* and *E.coli*, where the zone of inhibition was (40.3 ± 1.5 and 28.3 ± 2.9 mm) respectively. The another essential oils showed moderate activity only on *Staphylococcus aureus*.

KEYWORDS: essential oils, Antibacterial activity, *Staphylococcus aureus*, *E.coli*.

INTRODUCTION

The microorganisms are developing resistance to many drugs and as such created situation where some of the common and less expensive antimicrobial agents are loosing effectiveness.[1] Herbal medicine which uses medicinal plants primarily presents as an alternative to such situation.[2] Several reports have indicated antibacterial activities of essential oils from medicinal plants which have been traditionally used as antibacterial agents.[3-8]

Medicinal plants such as *Ocimum gratissimum* and *Piper guineense* have been asserted to provide various culinary and medicinal properties. These medicinal properties exert bacteriostatic and bacteriocidal effects on some bacteria. These effects have been attributed to

the peptides, alkaloids, essential oils, phenols and flavonols which are major components in these plants.[9]

It has been found that *Piper nigrum* leaf extract inhibits the growth of *Pseudomonas aeruginosa*.[10, 11] describes the antimicrobial activity of volatile oils of black pepper against *Bacillus subtilis, Pseudomonas aeruginosa, Aspergillus niger, Candida albicans* and *Saccharomyces cervisisae.*

Cinnamon have been used in foods since antiquity.[12] Major antimicrobial components in cinnamon have been reported to be cinnamaldehyde[13], which have been given special attention to find their antibacterial activity against food borne pathogens. Cinnamaldehyde has been reported to inhibit the growth of S. aureus[14], E. coli O157 : H7, and Salmonella Typhimurium.[15]

Zingiber officinale has been used as a medicinal plant in Asia, India, Jamaica and Nigeria. Ginger contains 1-2% oil, which imparts the unique flavor to the spice and it has been studied by many workers.[16] Many reports are available on the chemical composition of fresh ginger oil and the naturally occurring flavoring compounds.[17, 18] Some reports are available on the antimicrobial property of the volatile oil from the rhizomes of ginger.[19-22]

MATERIALS AND METHODS

Essential oils: Four essential oils of *Piper nigrum, Ocimum basilicum, Zingiber officinale* and *Cinnamum zeylanicum* were commercially purchased from pharmacy, Dagestan (table 1).

Sr.No	Essential oils	Common name	Family
1	*Piper nigrum*	Black Pepper	Piperaceae
2	*Ocimum basilicum*	Basil	Lamiaceae
3	*Zingiber officinale*	Ginger	Zingiberaceae
4	*Cinnamum zeylanicum*	Cinnamon	Lauraceae

ISOLATION OF BACTERIA

A *Staphylococcus aureus and E. coli* isolated from inpatients hospitalized in Infectious Disease Hospital, Dagestan State Medical Academy. The processes of bacterial culturing and the identification of bacterial specimens were done at the bacteriological laboratory.

ANTIMICROBIAL ACTIVITY ASSAY

The Antibacterial activity of the essential oils were individually tested against *Staphylococcus aureus* and *E. coli*. The oils were assessed using a well Agar diffusion test.[23] AGV agar was used with 0.3 ml essential oils. The distilled water was served as a negative control and the penicillin, erythromycin and tetracycline (30 μg) for *Staphylococcus aureus* ,where erythromycin and tetracycline for *E. coli* as a positive control. The Antimicrobial activity was measured using well diffusion method according to the National Committee for Clinical Laboratory Standard.[24] All tests were performed in triplicate.

RESULTS AND DISCUSSION

Essential oils are potential source of novel antimicrobial compounds especially against bacteria pathogen.[25] Four essential oils (table 1) were tested against the *Staphylococcus aureus* and *E. coli*. The all essential oils exhibited better antibacterial activity against the *staphylococcus aureus* than the *E. coli*. Table (2) shows the diameter zone of inhibition of bacterial growth by used essential oils. The *Staphylococcus aureus* and *E.coli* was found to be highly sensitive to cinnamon oil (40.3 ± 1.5 and 28.3 ± 2.9 mm) respectively than used positive control, antibiotics (penicillin, Erythromycin and tetracycline). The another three essential oils showed lowest antibacterial activity on *staphylococcus aureus* than cinnamon oil, where no detected activity on *E. coli*. Also we observed that the weakly antibacterial activity of black Pepper, basil and Ginger in comparing to positive control activity.

In the present study it was revealed that *staphylococcus aureus* is more susceptible towards studied essential oils than *E. coli*. Among the three essential oils, Cinnamon essential oil shows maximum activity against *staphylococcus aureus* and *E.coli*. SINGH *et al*[26] findings support the present results where Cinnamon essential oil showed maximum activity against E. coli, *Klebsiella pneumonia* and *Pseudomonas aeruginosa*.

Taura *et al*,[27] stated that *Piper nigrum* and *Zingiber Officinale* shows activity on *staphylococcus aureus* and *Klebsiella pneumonia* and weakly active against *Escherichia coli* and *Pseudomonas aeruginosa*. *Shiva Rani et al*[28] were found, *Piper nigrum* showed moderate antibacterial activity against *staphylococcus aureus* and a low activity against *Escherichia coli*. Previous studies reported that basil essential oil exhibited good antimicrobial activity against a positive and negative gram bacteria.[29]

Table (2): Antimicrobial activity of some essential oils against *staphylococcus aureus* and E. coli.

Essential oils/control groups	Zone of inhibition (mm)	
	Staphylococcus aureus	***Escherichia coli*.**
Distil water (-ve control)	Nd	Nd
Pencillin (+ve control)	31 ± 1	Nd
Erythromycin (+ve control)	28 ± 6.1	12.3 ± 0.6
Tetracycline (+ve control)	16 ± 1	25 ± 1
Piper nigrum	15.3 ± 2.3	Nd
Ocimum basilicum	13.3 ± 1.7	Nd
Zingiber officinale	18.3 ± 2.1	Nd
Cinnamum zeylanicum	40.3 ± 1.5	28.3 ± 2.9

Nd: no detection, -ve: negative, +ve: positive

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