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RESEARCH ARTICLE

ANTIBACTERIAL ACTIVITY OF EUCALYPTUS OIL AGAINST URINARY ISOLATES OF *ESCHERICHIA COLI*

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ABSTRACT

One of the most common infectious diseases of humans is urinary tract infections (UTIs), caused by *Escherichia coli*, which responsible for more than 80% of cases worldwide. Eucalyptus species are well known as medicinal plants due to their biological and pharmacological properties. The aim of the present study was to determine the antibacterial activity of eucalyptus oil against clinical isolates of E. coli. The MIC of eucalyptus oil was appeared to be 0.125% for E. coli. Eucalyptus oil is found to have antibacterial activity against clinical isolates of E. coli. However, the studies on toxic and irritant properties of essential oils are imperative, especially when considering any new products for human administration.

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INTRODUCTION

One of the most common infectious diseases of humans is urinary tract infections (UTIs), caused by *Escherichia coli,* which responsible for more than 80% of cases worldwide ().Ronald, 2003 About 6 to 20% of the human populations are experiencing asymptomatic bacteriuria (ABU), depending on age and gender and nearly 50% of women suffer from cystitis in their lifetime (Foxman, 2002). Many ABU *E. coli* isolates are phylogenetically associated to virulent uropathogenic *E. coli* (UPEC) strains and some may have evolved from pathogenic strains by virulence attenuation (Mabbett *et al.,* 2009). Eucalyptus is one of the very important and most widely planted genera across the world (Akin *et al.,* 2010). It is a tall, evergreen tree, native to Australia and Tasmania, successfully introduced worldwide, now extensively planted in many other countries (Akin *et al.,* 2010). It was introduced in Algeria in 1854 by Ramel (Bajajm 1995) Eucalyptus species are well known as medicinal plants due to their biological and pharmacological properties. In the international pharmacopeia, the most important and represented species, however, is Eucalyptus globulus (E. globulus) which is the main furnisher of essential oils. These essential oils have different applications as anesthetic, anodyne, antiseptic, astringent, deodorant, diaphoretic, disinfectant, expectorant, febrifuge, fumigant, hemostat, inhalant, insect repellant, preventitive, rubefacient, sedative yet stimulant, vermifuge, for a folk remedy for abscess, arthritis, asthma, boils, bronchitis, burns, cancer, diabetes, diarrhea, diphtheria, dysentery, encephalitis, enteritis, erysipelas, fever, flu, inflammation, laryngalgia, laryngitis, leprosy, malaria, mastitis, miasma, pharygnitis, phthisis, rhinitis, sores, sore throat, spasms, trachalgia, worms, and wounds. Sometimes their demand is also high in the soap and cosmetic industries (Boulekbache-Makhlouf *et al.,* 2010). Thus, the aim of the present study was to determine the antibacterial activity of eucalyptus oil against clinical isolates of E. coli.

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MATERIALS AND METHODS

Bacterial isolates

A total of 20 non repetitive urinary isolates of E. coli were collected from Saveetha Medical College and Hospitals, Chennai. They were processed for a battery of standard biochemical tests and confirmed. Isolates were preserved in semisolid trypticase soy broth stock and were stored at 4 ºC until further use.

Antibiotic susceptibility testing

Antibiotic susceptibility test was determined for these isolates to routinely used antibiotics such as ampicillin, amoxicillin,

amikacin, norfloxacin, ceftazimide, cefotaxime, ciprofloxacin and gentamicin, imipenem as by Kirby Bauer disc diffusion method (Clinical and Laboratory Standards Institute, 2015).

Table 1. Antibiotic sensitivity pattern of E.coli

Antibiotics	Sensitivity(20) (%)	Intermediate(20) (%)	Resistant(20) (%)
Ampicillin	5	0	95
Amoxicillin	5	0	95
Ceftazidime	10	10	80
Cefotaxime	5	5	90
Amikacin	70	10	20
Gentamicin	45	20	35
Norfloxacin	15	15	70
Ciprofloxacin	20	5	75
Imipenem	70	0	30

Detection of antibacterial activity of eucalyptus oil against clinical isolates of E. coli

Anti-bacterial activity of eucalyptus oil was tested against E. coli isolates by minimum inhibitory concentration method. Mueller Hinton broth was supplemented with 0.002% (V/V) tween 80 (HiMedia, Mumbai) to enhance the dispersion of the essential oils. Agar dilution method was performed to attain the different concentrations of essential oil such as 0.03%, 0.06%, 0.125%, 0.25%, 0.5%, 1% and 2% in Mueller Hinton Agar (MHA). Media containing various concentrations of essential oil were poured over the sterile petridishes and allowed to dry. Media without essential oil was served as control plate. Spot inoculation of 0.5 McFarland standard turbidity adjusted isolates were made on the plates and incubated at 37ºC for overnight. The lowest concentration of the essential oil that completely inhibited the growth of isolates was considered as MIC (Gopinath Prakasam *et al.,* 2014).

RESULTS

Sample wise distribution of clinical isolates of E.coli

Of the 20 clinical isolates of E.coli, 12/20 (60%) were from acute urinary tract infections and 8/20 (40%) were from chronic urinary tract infections. Figure 1 depicts the sample wise distribution of clinical isolates of E.coli.

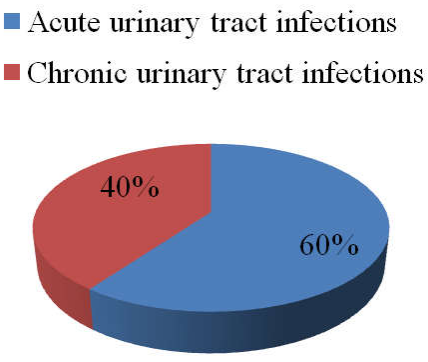

Figure 1: Sample wise distribution of urinary isolates of *E.coli*

Antibiotic susceptibility testing

In our isolates, we have found increased percentage 14/20 (70%) of isolates showed sensitivity to amikacin followed by gentamicin, which showed sensitivity of 9/20 (45%). 80- 90% of E.coli isolates showed resistance to cephalosporin group of drugs. 6/20 (30%) were found to be resistant to imipenem. However, we have observed an elevated level of resistance to other routinely used antibiotics. The detailed resistant pattern of E.coli isolates were showed in table 1.

Result of antibacterial activity of eucalyptus oil against clinical isolates of E. coli

We have observed that, clinical isolates of E. coliwere inhibited from 0.125-0.25% of eucalyptus oil. The MIC of eucalyptus oil was appeared to be 0.125% for E. coli**.**

	0.03 %	0.06 %	0.125 %	0.25%	0.5 %	1 %	2 %
No. of organisms	0	0	12 (60)	8 (40)	0	0	0

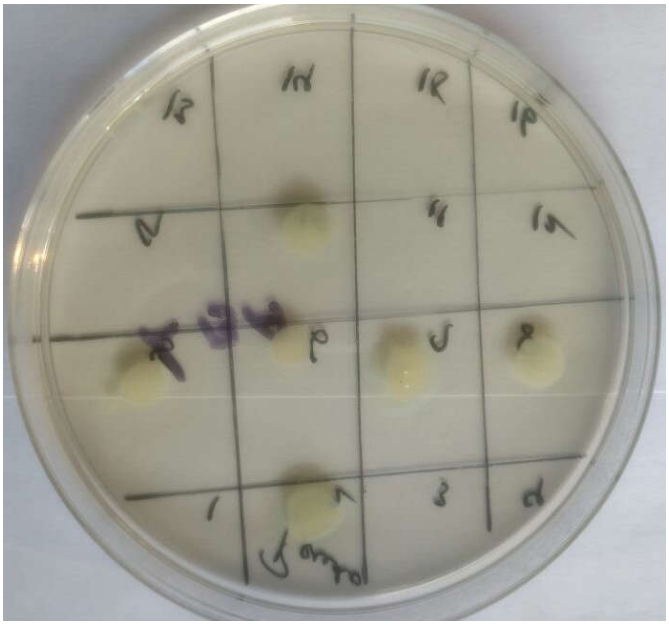

Fig. 2. Representative picture showing MIC/MBC of eucalyptus oil aginst E.coli

DISCUSSION

Study conducted by Prakasam *et al* from Chennai in 2014 demonstrated that, Acinetobacter strains were inhibited from 0.06 to 0.25%, 0.25-1% and 0.125-1% for clove, peppermint and eucalyptus oils respectively. In clove oil, 14/50 (28%) isolates were inhibited at 0.06%, 25/50 (50%) at 0.125% and 11/50 (22%) at 0.25% of clove oil. In peppermint oil, 34/50 (68%) isolates were inhibited at 0.25%, 12/50 (24%) and 4/50 (8%) were at 0.5% and 1% concentrations of peppermint oil respectively. In eucalyptus oils, 10/50 (20%) isolates were inhibited at 0.125%, 18/50 (36%) at 0.25%, 16/50 (32%) and 6/50 (12%) were at 0.5% and 1% respectively. Thus, the MIC of clove oil was found to be 0.06%, 0.25% for peppermint oil and 0.125% for eucalyptus oil (Gopinath Prakasam *et al.,* 2014). In contrast, in our study, we used eucalyptus oil against E. coli isolates. 60% of isolates were inhibited at 0.125%, whereas, 40% were at 0.25% of essential oil. Thus, the MIC of eucalyptus oil against E. coli was found to be 0.125%.

Conclusion

Eucalyptus oil is found to have antibacterial activity against clinical isolates of E. coli. . However, the studies on toxic and irritant properties of essential oils are imperative, especially when considering any new products for human administration. This can be used as alternative and complementary antibacterial agents for controlling the infections.

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