ANTIBACTERIAL ACTIVITY OF GINGER OIL AGAINST CLINICAL 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. 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. Ginger is an important spice in Thailand. In 2001, Thailand grew more than 30,000 million tons of ginger. The present study indented to determine the antibacterial activity of ginger oil against clinical isolates of E. coli. The MIC of ginger oil was appeared to be 0.06% for E. coli. Ginger 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.**

***Keywords*: *Escherichia coli,* MIC, ginger oil.**

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. [1] 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. [2] 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. [3]The use of essential oils from herbs and spices is a novel antimicrobial treatment to reduce the initial microorganism loads and those induced during processing of minimally processed fruit and vegetable. In herbs and spices, there are many antimicrobial compounds exhibiting a wide range of activities against bacteria, yeasts and fungi. Essential oils from plants have been suggested as natural preservatives not only for processed food product but also for fresh produce.[4]Ginger is an important spice in Thailand. In 2001, Thailand grew more than 30,000 million tons of ginger. It is widely used as an ingredient in the food, pharmaceutical, cosmetic and other industries. Ginger contains a unique flavor derived from both non-volatile and volatile oils. The pungent compounds are gingerol and shagaol, while zingiberene is a pre-dominant component of oils.[5] Some volatile compounds having antimicrobial properties are α-pinene, borneol, camphene and linalool.[6] The medicinal properties have been mainly used for treating the symptoms of vomiting, diarrhea, light-headedness, blurred vision, dyspepsia, tremors, decrease in body temperature and high blood pressure. Furthermore, 6-gingerol and 6-shagaol can reduce viability of gastric cancer cells.[7] Some ginger compounds such as α-pinene, borneol, camphene and linalool are responsible for its antimicrobial activities.[6] Ginger extracts have been reported to inhibit growth of Listeria monocytogenes, Salmonella typhimurium, Staphylococcus aureus, Bacillus cereus, B. subtilis, E. coli, F. moniliforme and Mycobacterium sp. [8] Ginger oils showed very good inhibition of Salinococcusroceus, H. turkmenicus and Halococcusmorrhuae isolated from salt cured fish.[9] Thus, the present study indented to determine the antibacterial activity of ginger oil against clinical isolates of E. coli.

MATERIALS AND METHODS

Bacterial isolates:

A total of 20 non repetitive urinary isolates of Escherichia 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. [10]

Detection of antibacterial activity of ginger oil against clinical isolates of E. coli:

Anti-bacterial activity of ginger 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) toenhance the dispersion of the essential oil. Agar dilution method was performed to attain thedifferent concentrations of essential oils 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 oils 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 oils that completely inhibited the growth of isolates was considered as MIC. [11]

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.

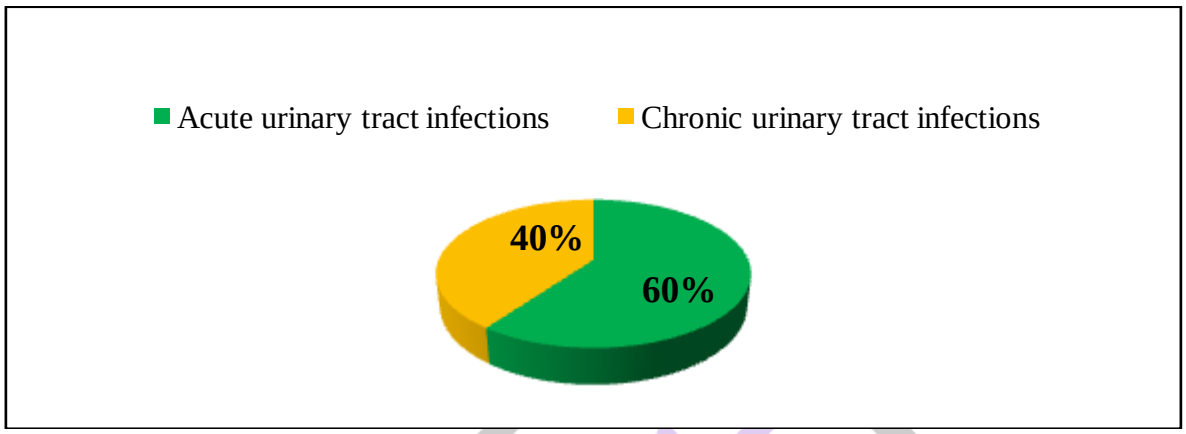

Figure 1: Sample wise distribution of urinary isolates of *E.coli*

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.

Table 1: showing 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

Result of antibacterial activity of ginger oil against clinical isolates of E. coli:

We have observed that, clinical isolates of E. coli were inhibited from 0.06-0.5% of ginger oil. The MIC of ginger oil was appeared to be 0.06% for E. coli**.**

Dilutions of ginger oil	**0.03%**	**0.06%**	**0.125%**	**0.25%**	**0.5%**	**1%**	**2%**
No. of organisms	0	14 (70%)	3 (15)	2 (10)	1 (5)	0	0

Figure 2: Representative picture showing MIC/MBC of E. coli against ginger oil.

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. [11]In contrast, in our study, we used ginger oil against E. coli isolates. 70% of isolates were inhibited at 0.06%, 15% were at 0.125%, 10% were at 0.25% and 5% were at 0.5% of essential oil. Thus, the MIC of tea tree oil against P. aeruginosa was found to be 0.25%.

CONCLUSION

Ginger 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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