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RESEARCH ARTICLE

ANTIBACTERIAL ACTIVITY OF GINGER OIL AGAINST CLINICAL ISOLATES OF *ENTEROCOCCUS* SPECIES

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ABSTRACT

Enterococci have changed over the previous century from being an intestinal commensal life form of minimal clinical significance to turning into the second most boundless nosocomial pathogen and is connected with extensive mortality and horribleness. 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. Thus, the present study indented to determine the antibacterial activity of ginger oil against clinical isolates of *Enterococcus* spp. The MIC of ginger oil was appeared to be 0.25% for *Enterococcus***.** The ginger oil is found to have antibacterial activity against *Enterococcus* species. 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

Enterococci have changed over the previous century from being an intestinal commensal life form of minimal clinical significance to turning into the second most boundless nosocomial pathogen and is connected with extensive mortality and horribleness. (Leclercq, 2002) Among the distinctive types of *Enterococci* which have been recognized, *Enterococcus* faecalis, was the most widely recognized species related with the nosocomial contaminations, trailed by *Enterococcus* faecium. (Weisblum, 1995) 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. (Ravindran and Babu, 2004) 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. (Nychas and Skandamis, 2003) Some volatile compounds having antimicrobial properties are α-pinene, borneol, camphene and linalool. (Ravindran and Babu, 2004) 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. (Nychas and Skandamis, 2003) Some ginger compounds such as α-pinene, borneol, camphene and linalool are responsible for its antimicrobial activities. (Ishiguro *et al*., 2007) 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. (Yamada *et al*., 1992) Ginger oils showed very good inhibition of Salinococcus roceus, H. turkmenicus and Halococcus morrhuae isolated from salt cured fish. (Prasad and Seenayya, 2000) Thus, the present study indented to determine the antibacterial activity of ginger oil against clinical isolates of *Enterococcus* spp.

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MATERIALS AND METHODS

Clinical isolates

A total of 20 different non-repetitive clinic isolates of *Enterococci* were collected from different clinical specimens were included in this study. These isolates were identified by standard biochemical parameters as described by elsewhere.

Isolates were preserved in semi-solid brain heart infusion medium and stored at 4ºC until further use.

Antimicrobial susceptibility test:

Antibiotic susceptibility test was determined for these strains to routinely used antibiotics such as ampicillin (10µ), vancomycin (30µ), teicoplanin (30µ), erythromycin (15µ), ciprofloxacin (5µ), amikacin (200µ), gentamycin (10µ), tetracycline (30µ) and linezolid (30µ) (Hi Media, Mumbai) by kirby-bauer disc diffusion method. (Clinical and Laboratory Standards Institute, 2015)

Detection of antibacterial activity of ginger oil against clinical isolates of *Enterococcus*

Anti-bacterial activity of ginger oil was tested against *Enterococcus* spp 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 oil. 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 *Enterococci*: We have isolated *Enterococcus* from different clinical specimens such as urine (60%), blood (20%), stool and wound swab (10%)

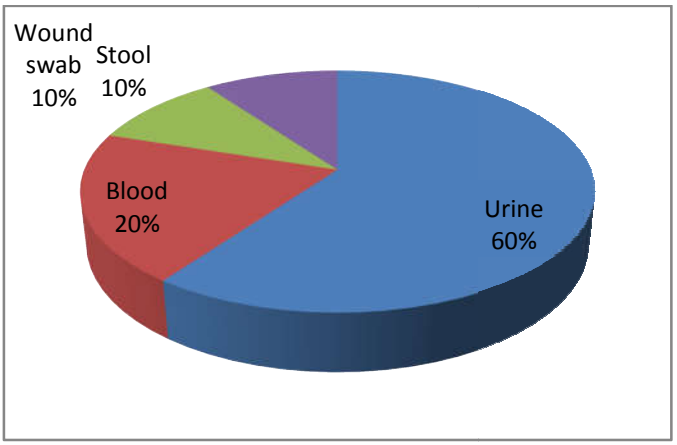

Fig.1. Pie chart showing the sample wise distribution of clinical isolates of *Enterococcus* spp.

Bacterial isolates

In our isolates, 70% were identified as E. faecalis and 30% of them were E. faecium

Antibiotic susceptibility testing

Increased percentage of isolates were shown to be resistant to most of the drugs used. Wherein, 90% were resistant to erythromycin as well as to amikacin, 85% of isolates were resistant to ampicillin, 80% isolates were to gentamycin. The detailed result of antibiotic susceptibility pattern was shown in Table 1.

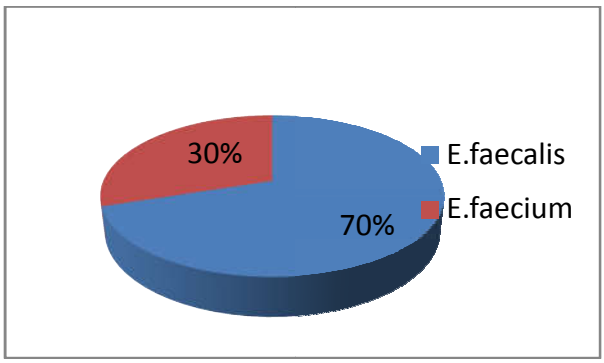

Fig. 2. Pie chart showing species distribution of *Enterococcus*

Table 1. Results of antibiotic sensitivity pattern of *Enterococci*

Antibiotics	Sensitivity	Intermediate	Resistance
Ampicillin	1(5%)	2(10%)	17(85%)
Vancomycin	15(75%)	1(5%)	4(20%)
Teicoplanin	12(60%)	3(15%)	5(25%)
Erythromycin	2(10%)	0	18(90%)
Ciprofloxacin	6(30%)	0	14(70%)
Amikacin	1(5%)	1(5%)	18(90%)
Gentamycin	2(10%)	2(10%)	16(80%)
Tetracycline	4(20%)	4(20%)	12(60%)
Linezolid	18(90%)	1(5%)	1(5%)

Result of antibacterial activity of ginger oil against clinical isolates of *Enterococcus* spp:

We have observed that, clinical isolates of *Enterococcus* were inhibited from 0.25-2% of ginger oil.

The MIC of ginger oil was appeared to be 0.25% for *Enterococcus*.

Dilutions of Ginger oil	0.03 %	0.06 %	0.125 %	0.25 %	0.5 %	1 %	2 %
No. of organisms	0	0	0	6(30)	8(40)	2(10)	4 (20)

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 ginger oil against Enterococcal isolates. 30% of isolates were inhibited at 0.25%, 40% were at 0.5%, 10% were at 1% and 20% were at 2% of

essential oil. Thus, the MIC of ginger oil against Enterococcal isolates was found to be 0.25%.

Conclusion

The ginger oil is found to have antibacterial activity against *Enterococcus* species. 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 this infection.

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