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RESEARCH ARTICLE

ANTIBACTERIAL ACTIVITY OF SPICES AND HERBAL EXTRACTS AGAINST EGG BACTERIA

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ABSTRACT

The effect of extract prepared from plant dried clove, garlic, ginger, pepper, thuthuvalai has been tested for their antibacterial activity against *Pseudomonas* sp. & *Bacillus* sp. The evaluation of antimicrobial activity of various plant extracts was carried out with crude aqueous acetone and methanol extracts. In this work, garlic extract was found to be effective against egg bacteria and results indicate that when plant extracts was prepared with distilled water, it shows lower zone of inhibition than with acetone and methanol extracts.

Key words: Antibacterial activity, plant extracts, egg bacteria.

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INTRODUCTION

Antibiotics have been effectively used for the control of bacterial diseases. However, due to indiscriminate use of these drugs, various pathogenic bacteria have developed resistance to many of the currently available antibiotics (WHO Scientific working group, 1983, Dostal, R.E.*et.al.,* 1992). The antimicrobial activity of essential oil from spices viz., ginger, cumin, coriander, clove showed various degree of inhibition against *Lactobacillus acidophilus* and *Bacillus cereus* by paper disc diffusion method (Meena and Vijaysethi, (1994). The antimicrobial activity of garlic extract has been studied by many researchers .The heated garlic extract is also studied for its antimicrobial activity (Kim, M.H *et al.,*(2001). The effectiveness of cardamom, arise, basil, coriander, rosemary, parsley, lill and angalica essential oil for controlling the growth and survival of pathogenic and saprophytic microorganisms (Elgayyar *et al*., (2002). The antimicrobial activity of aqueous ethanolic, methanolic and phenolic extracts from three palestinian folk medicinal plant in addition to their commercial oil against the pathogenic microorganisms (Astal *et al*., (2005). Both gram- positive and gram –negative organisms were used for testing antimicrobial activity of garlic extract possessed more anti-bacterial activity against *Bacillus cereus, Staphylococcus aureus, Salmonella typhi,* and *Proteus vulgaris.* Herbs and spices parts of plants from indigenous or exotic origin are essential part of human diet as they improve taste, color and aroma of foods. In addition they act as preservatives in many foods; they also have antioxidant and antimicrobial properties. The aim of this study is to determine the antimicrobial activity of some local spices of India that are routinely used in food, has been investigated against clinically important bacterial pathogens viz., *Pseudomonas* sp. and *Bacillus* sp.

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MATERIALS AND METHODS

Preparation of extracts

The dried garlic, pepper, thuthuvalai for the preparation of extract .The extract plant parts were grounded and powdered. The powder is used for the preparation of crude aqueous, acetone, methanol extract. For this five hundred mg of powder was dissolved in 10 ml of distilled water, acetone, methanol individually. These extracts at 5.0 per cent concentration testing antimicrobial activity against spoilage and pathogenic bacteria.

Test organisms

Both Gram-positive and Gram-negative organisms were used for the testing antimicrobial activity of five plant extracts viz., clove, garlic, ginger, ginger, pepper, thuthuvalai. The Gram-positive organisms include *Bacillus* sp. The Gram-negative organisms *Pseudomonas* sp. 0.1-0.2 ml of log culture of these

microorganisms were used as inoculum for testing antimicrobial activity.

Testing of antimicrobial activity

Testing of antimicrobial activity of the plant extracts by well diffusion methods. Well diffusion method was followed for the evaluation of antibacterial activity of five plant extracts viz., clove, garlic, ginger, pepper and thuthuvalai. Sterilized nutrient agar medium was prepared, poured in sterile petriplates and allowed for solidification .The standard inoculum was prepared, poured in sterile petriplates and allowed for solidification .The prepared standard inoculum was used to spread the cell suspension by using 'L' rod. The stainless steel cork borer used to make the one cm diameter well, each well was filled with the aqueous extracts of 0.6 ml per well for all the selected plants. The plates were incubated at 37^{o} C for 24 hours, after which they were observed for the zones was calculated and expressed in mm.

RESULTS AND DISCUSSION

The results on the inhibitory effects of aqueous, acetone and methanol extracts of the selected plants against the *Escherichia sp*., *Staphylococcus sp.* and *Salmonella sp.* were studied and the results were given in (Table1,2 &3). Of all the five plants extracts prepared in three solvents, garlic exhibited more inhibitory activity against *Escherichia sp*., *Staphylococcus sp.* and *Salmonella sp.* to other four plant extracts. The acetone extract of all the five plants recorded more mean inhibitory effects than methanol and aqueous extract. Among the various plant extracts and various solvents tested, the mean inhibition zone also differed. Garlic extract recorded more mean inhibition zone for the three egg bacteria, *Escherichia sp*., *Staphylococcus sp.* and *Salmonella sp* (23.37, 24.20 and 25.15 mm respectively) followed by clove, pepper, ginger and thuthuvalai extracts. Among the solvents tested acetone extracts of all the five plants recorded significantly more mean inhibition zone (23.99 mm, 24.35 and 25.20 mm) followed by methanol (22.00, 21.45 &24.22 mm) and aqueous (16.25 mm, 16.02 & 16.54 mm). respectively. The results are in accordance with that of Mahfuzul Hoque *et al.,* (2007), Pandey and Singh (2011) and Ashraf *et al.,* (2018). The bioactive compounds of ginger rendering antimicrobial activity are volatile nature and antimicrobial activity of ginger extract decrease upon storage (Roy *et al*., 2006). In addition to water, methanol and ethanol were also used for extract preparation as De Boer *et al*.,(2005) has reported that bioactive compounds show better solubility in water miscible organic solvents. The antimicrobial activity shown by garlic extract in their study agrees with findings of Belguith *et al.,* (2010), Yin *et al.,* (2002), Bakht *et al.,* (2011), Iwalokun *et al.,* (2004) and O'Gara *et al.,* (2000). Garlic is also rich in anionic compounds such as nitrates, chlorides and sulfates and other water soluble components found in plants and these compounds may have antimicrobial properties (Yusha'u *et al.,* 2008). The results revealed that garlic extracts were more effective against the test organisms than ginger extracts for *Bacillus* sp. (Ogodo and Ekeleme, 2013). The antimicrobial activity of spices is due to specific phytochemical or essential oils (Avato et al.,(2000); Gull et al(2012) .Also in a study by Melvin et al.,(2009),the ginger extract , however showed only a moderate antimicrobial activity against *S. aureus*.

Conclusion

The result of the study emphasizes the usefulness of spices in the treatment of diseases and the need to enhance its exploitation o n this regard. This is particularly of urgent

Table 1. Inhibitory effect of selected plant extracts against egg bacteria *Escherichia sp*. (EB-3) (Well diffusion method)

Name of the plant	Aqueous extract (5.0%)		Acetone extract (5.0%)		Methanol extract (5.0%)		Mean
	Inhibition zone (mm)	Growth inhibition (%)	Inhibition zone (mm)	Growth inhibition (%)	Inhibition zone (mm)	Growth inhibition (%)	
Clove	17.83	19.81	25.78	28.03	23.80	26.44	22.47
Garlic	18.90	21.00	26.00	28.88	25.03	28.03	23.37
Ginger	15.23	16.92	22.90	27.00	20.63	22.92	19.58
Pepper	16.17	17.96	24.30	27.00	21.90	24.33	20.79
Thuthuvalai	13.13	19.81	21.00	23.33	18.66	16.67	17.59
Mean	16.25		23.99		22.00		
SEd	0.2340		0.6056		0.8206		
CD (p=0.05)	0.5406		1.3990		1.8957		

Table 2. Inhibitory effect of selected plant extracts against egg bacteria *Staphylococcus sp.* (EB-4) (Well diffusion method)

Name of the plant	Aqueous extract (5.0%)		Acetone extract (5.0%)		Methanol extract (5.0%)		Mean
	Inhibition zone (mm)	Growth inhibition (%)	Inhibition zone (mm)	Growth inhibition (%)	Inhibition zone (mm)	Growth inhibition (%)	
Clove	18.37	20.41	26.23	29.14	21.97	24.41	22.19
Garlic	19.27	21.41	27.70	30.77	25.63	28.47	24.20
Ginger	14.03	21.41	22.90	25.44	20.00	22.22	18.97
Pepper	17.43	19.36	24.53	27.25	21.02	28.47	20.99
Thuthuvalai	11.03	12.25	20.40	22.66	18.67	20.74	16.70
Mean	16.02		24.35		21.45		
SEd	0.2776		0.3484		0.3069		
CD (p=0.05)	0.6414		0.8047		0.7089		

Table 3. Inhibitory effect of selected plant extracts against egg bacteria *Salmonella sp.* (EB-5) (Well diffusion method)

Name of the plant	Aqueous extract (5.0%)		Acetone extract (5.0%)		Methanol extract (5.0%)		Mean
	Inhibition zone (mm)	Growth inhibition (%)	Inhibition zone (mm)	Growth inhibition (%)	Inhibition zone (mm)	Growth inhibition (%)	
Clove	18.70	21.88	27.03	30.03	25.23	28.03	23.65
Garlic	20.13	22.36	28.23	31.36	2710	30.11	25.15
Ginger	14.27	15.85	23.40	26.00	23.07	25.63	20.24
Pepper	16.37	18.18	25.30	28.11	24.03	26.70	21.90
Thuthuvalai	13.27	14.74	22.07	24.52	21.67	24.07	19.00
Mean	16.54		25.20		24.22		
SEd	0.3121		0.3664		03871		
CD (p=0.05)	0.7210		0.8464		08942		

interest when the growth rate of multi-resistant drug strains of bacteria worldwide is considered (Prescott *et al.,* 2005). The results of present study have provided the justification for therapeutic potential of spices. The practice of using spices as supplementary or alternative medicine in developing countries like Nigeria & Pakistan will not reduce only burden of drug resistance development but also the side effects and cost of the treatment with allopathic medicine. It can also be used as a potential inhibitor of food pathogens and prevent food poisoning. Shelf life of processed foods could be increased if garlic is used in the preservation of foods for pathogenic organisms than other spices. In comparison thuthuvalai has weaker antibacterial and maybe used along with garlic as an antibacterial agent. However, further studies need to be conducted to determine if better antibacterial activity is achieved by combining the species.

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