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ORIGINAL ARTICLE **OPEN ACCESS**

EVALUATION OF ANTIMICROBIAL ACTIVITY OF SOME INDIAN SPICES AGAINST SOME BACTERIAL PATHOGENS

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ABSTRACT
The present study was demarcated to evaluate the antimicrobial activity of four Indian spice extracts, namely clove (Syzygium aromaticum), cinnamon (Cinnamomum verum), garlic (Allium sativum), cardamom (Elettaria cardamomum). Spices are imperative both as functional food ingredients and nutritional supplements as they not only enhance the taste and flavor of foods, but also play a significant role as supplementary, complementary, and synergistic components. All of these have been traditionally used in folk medicine, and are still used in the alternative system of health care. The antimicrobial activity of these commonly used Indian spices were tested against some common bacteria, namely Escherichia coli, Staphylococcus aureus, and Bacillus cereus, Salmonella typhi which are responsible for many health-related problems. These were tested using the Agar well / cup diffusion method. The results showed that the extracts of clove, cinnamon,and garlic, had good inhibitory action against all organisms while cardamom showed antimicrobial activity against only Staphylococcus. aureus.
***Keywords**: Antimicrobial, spices, clove, garlic, cardamom.*

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INTRODUCTION

Several spices mainly garlic, clove, ginger, cumin are used widely in the Indian diet and in Indian medicine. The spices used in Indian cooking have been used for ages for adding flavor and for the treatment of common infectious diseases.

The antibacterial properties of garlic are widely used for several common infectious diseases. Eugenol, the principal component of clove is used as, an antiseptic and possesses local anesthetic activity; it is therefore used for toothache. For thousands of years, clove oil (eugenol) has been used in dentistry. Eugenol is the main antimicrobial component present in *Syzygium aromaticum*, which shows antibacterial activity against many pathogens. Eugenol in clove can disrupt bacterial membranes [8]. cardamon, the queen of all species, has a history as old as humans.

Cinnamon's unique healing ability comes from three basic types of components in essential oil found in its bark.These oil content activecomponents called cinnamaldehyde, cinnamyl acetate, and cinnamyl alcohol.

It is imperative to study their antimicrobial activity against common human pathogens so that the best spices can be further subjugated to determine their active component which can be used for developing drugs. The present study was aimed at studying the antimicrobial activity of clove (*Syzygium aromaticum*), cinnamon (*Cinnamomum zeylanicum*), garlic (*Allium sativum*), cardamom (*Elettaria cardamomum*)and against common human pathogens. To find out the minimum inhibitory concentration (MIC) of the extracts of garlic, clove, cinnamon, and cardamom against some common human bacterial pathogens.

MATERIAL AND METHODS

Sample collection:

The spices were obtained from the local market at Karad. The test organisms were taken from the Department of Microbiology, Krishna Institute of Allied Sciences, Karad.

The spices were air-dried at room temperature and ground into fine powder. Three 1% extracts viz., aqueous, ethanolic, and methanolic were prepared. The extracts were prepared by dissolving spice powder in 100 mL solvents and kept at 30 ^{0} C for 24hrs in a sterile beaker and then subjected to filtration

through sterilized Whatman no. 1 filter paper. The solvent was dried and concentrated using a shaker at 40°C. These filtrate extracts were further used for examining the effect of spices. The extracts were considered as 100% concentration extract. Then the concentrations of 60%, 80%, and 100% were made by diluting the concentrated extracts with appropriate volumes of respective sterile solvents. [12]. The dilutions were made as 60%,80%, and 100% as follows:
For 60% dilution: (6ml of 100% spices extract + 4mLsolvent).
For 80% dilution:(8ml 100% spices extract + 2mL solvent.).

Agar cup/well diffusion method: (Cruickshank *et .al;* 1985)

The antimicrobial activity of all spices extracts was tested by the agar diffusion method.0.1 mL of suspension of the test organisms was spread on the sterile nutrient agar plate, separately. The wells were bored with a sterilized cork borer and were filled with 0.1 mL of spices extracts. The plates were kept in freeze for 30 min to allow diffusion of extracts. The plates were then incubated for 24 h- at 37 ^{0} C. The diameter of zones of inhibition were measured.[7]

RESULT AND DISCUSSION:

The result of the antimicrobial activity of various concentrations of the extracts of the spices- Garlic, Clove, Cinnamon, and Cardamom are shown in Tables - 1,2,3,4.

Table - 1. Zones of inhibition of the test organism (in Cm) by Garlic extract.

Test Microorganism	Zone of inhibition with Garlic extract		
	100%	80%	60%
Staphylococcus aureus	3.9	3.0	2.8
Salmonella typhi	3.0	2.8	2.6
E. coli	1.8	1.3	-
B. subtilis	1.2	-	-

'-' = no inhibition zone.

It was seen from Table 1, the different spices tested for their antimicrobial activity,*Staphylococcus aureus* shows maximum sensitivity to garlic extract at 100%,80%, and 60% concentration.

The largest zone of inhibition of 54 mm was measured for *Candidaalbicans*, while the least antimicrobial activity was demonstrated by the imported fresh garlic against the *Staphylococcus* aureus where the zone of inhibition was 9 mm. [16]

Table - 2. zones of inhibition of the test organism (in Cm) by Clove extract.

Test Microorganism	Zone of inhibition with Clove extract		
	100%	80%	60%
Staphylococcus aureus	2.0	1.7	1.5
Salmonella typhi	1.7	-	-
E. coli	1.7	-	-
B. subtilis	1.5	-	-

'-' = no inhibition zone.

It was observed from Table - 2, all test organisms were sensitive to Clove extract at 100% concentration. Only *Staphylococcus aureus* showed an inhibitory zone at 100%,80%, and 60% concentrations.

However, the clove oil was more effective as compared to clove extract against all the test bacterial species. The highest inhibition zone was produced against Halobacterium spp. and *Lactobacillus* spp. with an IZD of 19.0 mm each.[14]

Table -3. Zones of inhibition of the test organism (in Cm) by Cinnamon extract.

Test Microorganism	Zone of inhibition with Cinnamon extract		
	100%	80%	60%
Staphylococcus aureus	2.2	2.0	1.7
Salmonella typhi	1.6	1.4	-
E. coli	1.5	-	-
B. subtilis	1.4	-	-

'-' = no inhibition zone.

It was seen from Table- 3 that Cinnamon shows no antimicrobial activity against all four-test organisms viz *staphylococcus aureus*, *salmonella typhi*, *E. coli*, and *B. subtilis* at 100%. also observed that staphylococcus aureus shows maximum sensitivity to Cinnamon. Ethanol extracts of cinnamon were

potentially active against four foodborne pathogens with inhibition zones ranging from 7.11 to 10.11 mm. Both n-butane extracts and ethanol extracts showed no significant differential between gram-positive and gram-negative bacteria.[4]

Table - 4. Zones of inhibition of the test organism (in Cm) by Cardamom extract.

Test Microorganism	Zone of inhibition with Cardamom extract		
	100%	80%	60%
Staphylococcus aureus	1.8	1.3	-
Salmonella typhi	-	-	-
E. coli	-	-	-
B. subtilis	-	-	-

'-' = no inhibition zone.

It was observed from Table -4, that Cardamon shows no antimicrobial activity against *Salmonellatyphi*, E. *coli*, and *B. subtilis*. *Staphylococcus aureus* shows sensitivity at 100%, and 80%concentrations of Cardamom. There was a significant difference in the mean diameter of the zone of inhibition of 15% and 20% cardamom seed extract. Results showed that cardamom seed powder extracts had anti bacterial activity against streptococcus mutants, while antibacterial activity was significantly higher in 50% cardamom seed powder extract.[16].

CONCLUSION:

All tested organisms were sensitive to Garlic, Clove, and Cinnamon extract. Only Cardamom didnot show antimicrobial activity against *Salmonella*, *E. coli*, and *B. subtilis*. From the above result, it was concluded that Indian spices can alsobe used as potential antimicrobial compounds against many pathogenic organisms.

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