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ASSESSMENT OF ANTIBACTERIAL PROPERTIES OF SOME INDIAN SPICES

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ABSTRACT

Numerous studied have been published over the years concerning the inhibition of microorganisms by spices, their extracts and various constituents. Most of these products have string antimicrobial activity which is mainly attributed to a specific constituent in certain situations. The behavior of antibacterial activities largely depends on the microorganisms, spices and the mode of study. The metabolites were extracted by using polar and nonpolar solvents from spices such as small cardamom, clove, dry ginger, black pepper. The *K. pneumoniae and B. subtilis* and *E. coli* were used as for the assessment of the antibacterial properties of spices.

Key words: spices, microorganisms, organic solvents, small cardamom, metabolites

INTRODUCTION

Some of the spices and plants used today have been known to the ancient people. Cultures around the worlds have been admired for their preservation and apart from its taste and odor properties, therapeutic powers. Scientific studies on the antimicrobial effects of spices and herbs and their materials were known and important in the late 19th century **[1-5]**. This was also known at an initial point that the antiseptic capacity of spices and herbs are present in essential oil and in some instances it can be ascribed to the major components. Most of the published reports are concerned with the impact of the metabolites of spices and herbs on various pathogenic microorganisms **[6-8]**. Undoubtedly, the curiosity in these botanicals was sparked by a desire aim to collect antiseptic and disinfectant ingredients from natural sources. These will be better than synthetic antimicrobials. The thought remains important today, especially between researchers in the developing countries **[9]**. A laboratory research on the effect of spices on food preservation was first conducted by Hoffman and Evans (1911), although they said that it is a matter of general concern of knowledge that spices have a role to play in food preservation. They found that that the clove, cinnamon and mustard were very useful for the preservation of apple sauce **[10]**. Most of the spices and nutmeg had some preservative strength, while black pepper, cayenne, ginger did not have effective property. They ascribed antimicrobial activity of the essential oils of spices and proved that eugenol and cinnamaldehyde were inhibitory than benzoic acid **[11-14]**. While it was possess that many spices have been utilized for their antimicrobial properties in laboratory studies. However, soon it became obvious that the amounts usually used for the flavoring food and these components were not as effective as they were act as preservatives **[15].**

MATERIALS AND METHODS

Collection of samples:

Fresh spices such as small cardamom, clove, dry ginger, black pepper collected from local shops Vibhuti Khand, Lucknow. Spices were then pounded to powder with a mixer and grinder.

Bacterial strains reviving:

The pathogenic strains namely *K. pneumoniae and B.subtilis* and *E. coli* available at MRD LifeSciences (P) Ltd, Lucknow, obtained from Chandigarh, was subculture on Nutrient Agar Media and used throughout the project work **[16]**.

Extraction of active metabolites:

Spice powders of clove, black pepper, small cardamom, and dry ginger were dipped in organic solvents such as ethanol, chloroform, methanol, and acetone. The samples were filtered by using whatman's filter paper and the solvents were dried at room temperatures. Further these metabolites were scratched by using DMSO and preserved **[17, 18]**.

Antibiogram analysis:

The samples were screened for the antibacterial properties against the bacterial pathogens by using agar well diffusion method **[19]** and the dosage was evaluated by using broth dilution **[20]** method with respect to the metabolites.

Effects of metal ions on antibacterial property of metabolites:

Metal ion tends to possess an oliodynamic property which makes them toxic for microbes and living cells. Different concentrations of the metals were used for enhancing the activity of extracts **[21]**.

RESULTS AND DISCUSSIONS:

Extraction of active metabolites:

The metabolites extracted in the form of powder further it was dissolved in DMSO and preserved at -20°C. The extracted metabolites then screened for their antibacterial activities.

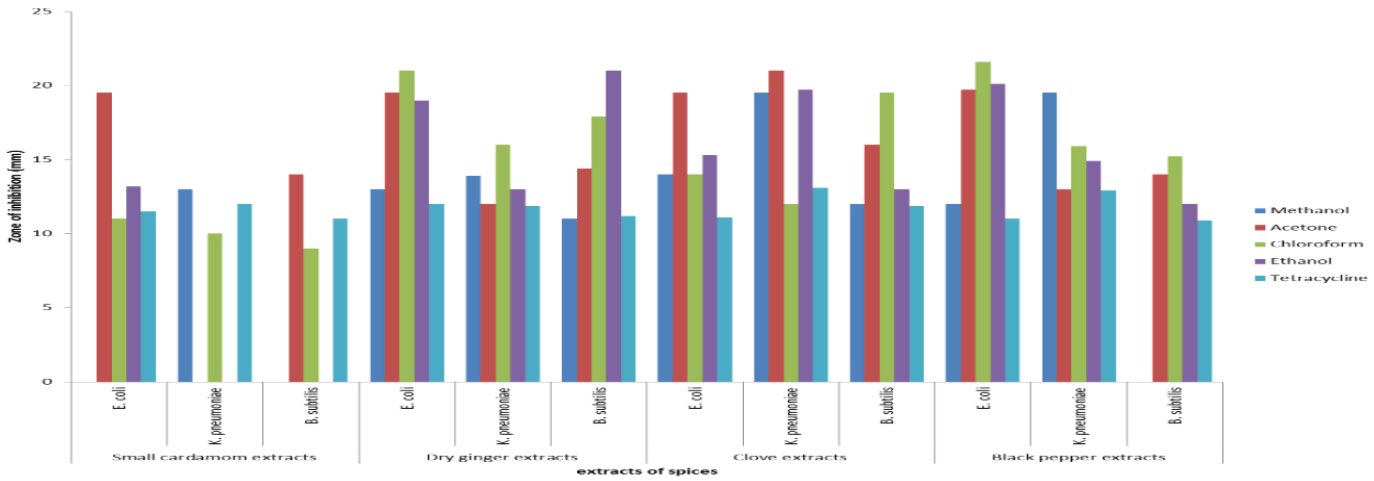
Antibacterial screening:

Antibacterial activity of methanol, acetone, chloroform, ethanol extract of small cardamom, clove, dry ginger, black pepper against *E.coli, K. pneumoniae and B.subtilis.* The best activity was shown by acetone extracts of all the spices.

Table 1. Antibacterial activity of methanol, acetone, chloroform, and ethanol extracts toward bacterial species.

S. no	PATHOGEN	ZONE OF INHIBITION (mm)				
		Methanol	Acetone	Chloroform	Ethanol	Tetracycline
Small cardamom extracts						
1	*E. coli*	0	19.5	11	13.2	11.5
2	*K. pneumoniae*	13	0	10	0	12
3	*B. subtilis*	0	14	9	0	11
Dry ginger extracts						
4	*E. coli*	13	19.5	21	19	12
5	*K. pneumoniae*	13.9	12	16	13	11.9
6	*B. subtilis*	11	14.4	17.9	21	11.2
Clove extracts						
7	*E. coli*	14	19.5	14	15.3	11.1
8	*K. pneumoniae*	19.5	21	12	19.7	13.1
9	*B. subtilis*	12	16	19.5	13	11.9
Black pepper extracts						
10	*E. coli*	12	19.7	21.6	20.1	11
11	*K. pneumoniae*	19.5	13	15.9	14.9	12.9
12	*B. subtilis*	0	14	15.2	12	10.9

Figure 1: Graphical analysis of antibacterial assessment of spices against bacterial pathogens.



Effect of $MgSO_4$ metal salt on extracts:

The significance of $MgSO_4$ metal salt on acetone extract of small cardamom, clove, dry ginger, black pepper were checked against *E.coli, K. pneumoniae and B.subtilis.* The effective results were obtained by the 1% concentration of salt with all the acetone extracts of all the spices.

Table 2. Antibacterial activity of effect of $MgSO_4$ metal salt on acetone extracts of all spices.

S. no	PATHOGEN	ZONE OF INHIBITION				
		0.5%	1%	1.5%	$MgSO_4$	Control
Small cardamom extract						
1	*E. coli*	11	13.5	11.5	0	10
2	*K. pneumoniae*	16.4	10	12	0	14
3	*B. subtilis*	17.9	11	11	0	11
Dry ginger extract						
4	*E. coli*	12.5	14	11	0	12
5	*K. pneumoniae*	13.0	11	19	0	11
6	*B. subtilis*	13.5	9	11.1	0	12
Clove extract						
7	*E. coli*	0	18	14.2	0	9
8	*K. pneumoniae*	13	12	11.9	0	10
9	*B. subtilis*	10	11	11	0	11
Black pepper extract						
10	*E. coli*	11.5	15.3	11.6	0	10.5
11	*K. pneumoniae*	10	19.7	18.9	0	11.5
12	*B. subtilis*	11	13	16.2	0	15

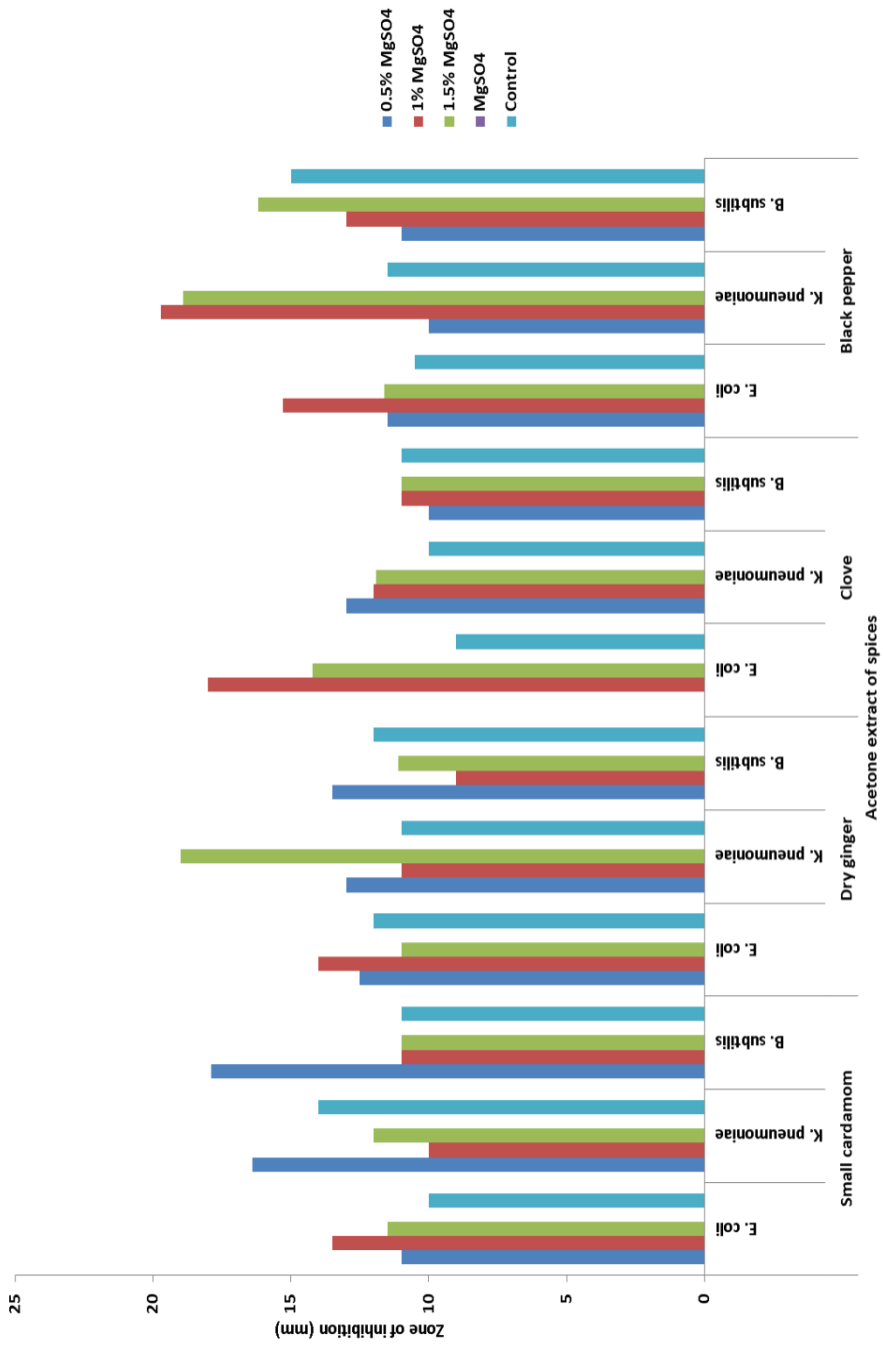


Figure 2: Analysis of the metal salt effect on acetone extracts of different spices against bacterial pathogens

Dosage calculation by MIC test:

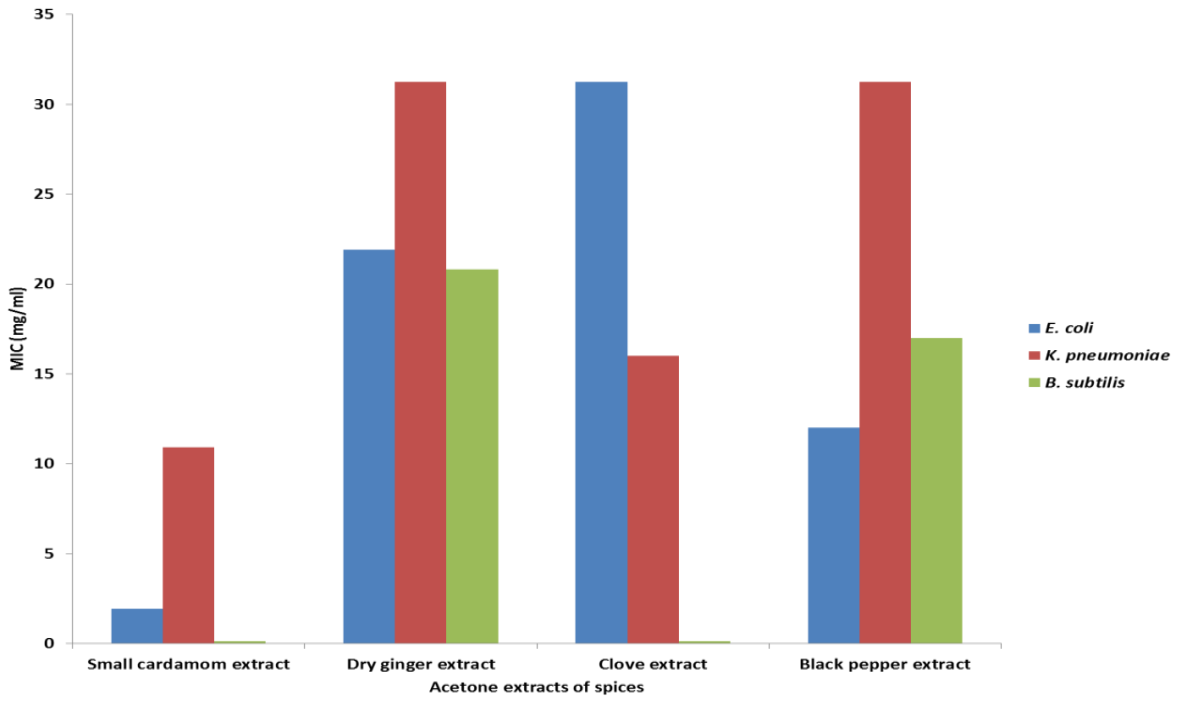


Figure 3: Graphical analysis of MIC values of spices against pathogens

CONCLUSION:

In conclusion, the degree of antibacterial properties of spices tested is effective. Such spices may be chosen for use as possibly beneficial anti-microbial agents in fermented goods and other foods ingredient, based on the taste of food items. The oil fraction of these spices is preferred, with the exception of holy basil which can be used in the form of acetone extract. However, there are certain drawbacks in the use spices, such as 1) the loss of antimicrobial activity when spices are applied to food products containing sugar, carbohydrate, fat and protein, and 2) the strong taste of certain spices. The general taste of the products may not be appropriate if a significant number of spices have to be applied to the products in order to kill the pathogenic bacteria.

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