Vol II Issue XII Jan 2013
Impact Factor : 0.2105
ISSN No : 2230-7850

Monthly Multidisciplinary
Research Journal

Indian Streams Research Journal

IMPACT FACTOR : 0.2105

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RNI MAHMUL/2011/38595 **ISSN No.2230-7850**

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Indian Streams Research Journal
Volume 2, Issue.12,Jan. 2013
ISSN:-2230-7850
Available online at www.isrj.net
ORIGINAL ARTICLE

ANTIMICROBIAL ACTIVITY OF ALLIUM SATIVAM AND ZINGIBER OFFICINALE EXTRACTS AGAINST FOOD BORNE PATHOGENS

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Abstract:

Herbal and spices are very important and useful as therapeutic against many pathogenic infections. Most bacteria are sensitive to the extracts from spices such as clove, ginger, garlic, mustard, onion, oregano, turmeric etc. Spices such as garlic and ginger have been used as antimicrobial agents against E.coli and Klebsiella sp by using well diffusion method. The spices extracts prepared by using three solvents methanol, ethanol and aqueous. According to the result among the selected spices garlic had the inhibitory activity showed maximum zone 0f 26mm against Klebsiella sp and a zone of 23mm against E.coli. The aqueous extracts of garlic were more effective than methanol and ethanol extract. In case of ginger ethanol extract showed maximum zone of inhibition 25mm against klebsiella sp and minimal zone was recorded in 11mm aqueous extract. The minimum inhibitory concentration of different bacterial species varied from 0.2mg/ml to 1.0mg/ml.

KEYWORDS:

Garlic, Ginger, Antimicrobial activity, Extracts

INTRODUCTION

Spices are well known for their medicinal value from ancient time onwards. Spices are defined as plant substances used to enhance flavor, they include leaves (mint and coriander), flower (clover), bulbs (garlic and turmeric), fruits (black pepper), stem (cinnamon), rhizomes (ginger and turmeric) (Shelef, 1983).

Most of the foods borne bacterial pathogens are sensitive to extracts from plants such as garlic, mustard, onion and oregano. Garlic is therapeutically effective because of its oil and water soluble organosulfur compound, thiosulfinates is mainly responsible for its antibiotic activity as (Hughes and Lawson, 1991) reported that if, extract is free from thiosulfinates the antimicrobial capacity will be lost. Garlic has antibacterial and antifungal activity and contains powerful sulfur and numerous phenolic compounds (Benkeblia, 2004). Several studies showed that garlic, clove, black pepper and cinnamon had strong and consistent inhibitory effect against several foods borne pathogen (Shelef et al., 1980; Aureli et al 1992; conner, 1993).

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 food, pharmaceutical, cosmetic and other industries. The pungent compounds are gingerol and shagaol, while zingerberene is a pre-dominant component of oils (Ravindran and babu, 2004). Some ginger compound such as α-pinene, borneol, camphene and linalool are responsible for its antimicrobial activities (Nychas & Skandamis, 2003). 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; Hiserodt

Title : ANTIMICROBIAL ACTIVITY OF ALLIUM SATIVAM AND ZINGIBER OFFICINALE EXTRACTS AGAINST FOOD BORNE PATHOGENS Source:Indian Streams Research Journal [2230-7850] S. ELAMATHY AND KANCHANA. D yr:2013 vol:2 iss:12

et al., 1998; Thongson et al., 2005; Natta et al., 2008; Singh et al., 2008). The present study was aimed to investigate the antibacterial activity of garlic and ginger.

MATERIALS AND METHODS

SAMPLE COLLECTION

Garlic (Allium sativum) and ginger (Zingiber officinale) used in the present study were purchased from the local market of Chidambaram, Tamilnadu, India.

BACTERIAL STRAINS

Five different bacterial strains including E.coli and Klebsiella sp. were isolated from red meat. The strains were maintained on Nutrient agar slants.

PREPARATION OF EXTRACT

Three types of extracts such as methanol, ethanol and aqueous extract from garlic and ginger were prepared separately. The one gram of fresh garlic and ginger were washed, peeled sliced and macerated in pestle and mortar with ten ml of methanol, ethanol and aqueous. After maceration, it was filtered through double layered cheese cloth. Then the filtrate was collected and stored in refrigerator.

METHOD FOR TESTING ANTIMICROBIAL PROPERTIES OF SPICES EXTRACTS

AGAR WELL DIFFUSION METHOD

The Muller-Hinton agar medium was prepared and Seeded with one ml cell suspension of the five bacterial strains, Escherichia coli and Klebsiella sp. The seeded medium was poured in sterile petriplates and cork bore is used to form the well (6 mm size) and filled with spice extracts prepared at 10, 20, 30, 40 and 50µl levels in different solvents such as methanol, ethanol and aqueous. The spice extracts were separately poured in to well. After the incubation period, the inhibition zones were measured.

MINIMUM INHIBITORY CONCENTRATION METHOD

To estimate the minimum inhibitory concentration (MIC) of a spice extract to inhibit the growth of a particular organism, nutrient broth with bacterial suspension is poured into separate test tubes and different concentrations of spice extract are added. The tube exhibiting no growth is the MIC of the spice extract to the organism.

Table 1: Antibacterial activity of different extract of garlic and ginger against *E.coli* by well diffusion method

Mean diameter of inhibition zone (mm) of garlic and ginger						
Concentration in µl	**Garlic**			**Ginger**		
	Methanol extract	Ethanol extract	Aqueous extract	Methanol extract	Ethanol extract	Aqueous extract
10	12.00	11.33	14.33	14.00	15.00	12.00
20	14.00	13.00	15.00	16.33	16.66	14.00
30	15.33	14.00	17.00	18.00	18.00	16.00
40	17.00	16.33	20.00	19.66	21.00	17.66
50	20.00	19.00	23.00	24.00	23.00	22.00

Table 2: Antibacterial activity of different extract of garlic and ginger against *Klebsiella* sp by well diffusion method

Mean diameter of inhibition zone (mm) of garlic and ginger						
Concentration in µl	**Garlic**			**Ginger**		
	Methanol extract	Ethanol extract	Aqueous extract	Methanol extract	Ethanol extract	Aqueous extract
10	12.00	11.33	15.66	12.00	13.00	11.00
20	14.00	14.00	17.00	15.00	15.00	13.00
30	16.33	15.66	19.66	17.66	17.66	15.00
40	19.66	16.33	24.00	19.00	19.66	18.00
50	24.00	22.00	26.00	22.00	25.00	23.00

Table 3: Minimal inhibitory concentration of different garlic and ginger extract against *E.coli*

Name of the Spices	**Spices extracts of different concentration (ml)**														
	Methanol extract					**Ethanol extract**					**Aqueous extract**				
	0.2	0.4	0.6	0.8	1.0	0.2	0.4	0.6	0.8	1.0	0.2	0.4	0.6	0.8	1.0
Garlic	+++	++	+	-	-	++	++	+	-	-	+++	++	+	-	-
Ginger	++	++	+	-	-	+++	++	+	-	-	+++	++	+	-	-

+++more growth, ++moderate growth, +Poor growth, -No growth

Table 4: Minimal inhibitory concentration of different garlic and ginger extract against *Klebsiella* sp

Name of the Spices	**Spices extracts of different concentration (ml)**														
	Methanol extract					**Ethanol extract**					**Aqueous extract**				
	0.2	0.4	0.6	0.8	1.0	0.2	0.4	0.6	0.8	1.0	0.2	0.4	0.6	0.8	1.0
Garlic	+++	++	+	-	-	++	++	+	-	-	++	++	++	-	-
Ginger	++	++	+	-	-	++	++	+	-	-	+++	++	++	-	-

+++more growth, ++ moderate growth, +Poor growth, - No growth

RESULT AND DISCUSSION

The antimicrobial activity of spices namely garlic (Allium sativum) and ginger (Zingiber officinale) were tested against E.coli and Klebsiella sp are summarized in (Table 1&2) by using well diffusion method. Konning et al. (2004) found that the methanol extracts of the plant were significantly active against the bacteria Gram (+) and Gram (-) and fungi studied. The extracts were less active against P. aeruginosa, which is naturally resistant to antibacterial agents (Walker and Edwards, 1999). In a similiar study, Bonjar et al. (2004) the methanol extracts of Z. officinale was active against to all of Gram (+) bacteria The minimal inhibitory concentration of different garlic and ginger extract against E.coli and Klebsiella sp in (Table 3& 4). The zone of inhibition were ranged between 11 to 26mm.The two spices used in research study were effective against the tested bacterial strains but the best activity was showed by garlic aqueous extract forming a maximum zone of 26mm (50µl) against Klebsiella spp and 23mm (50µl) against E.coli. The ginger ethanol extract showed maximum zone of inhibition 25mm against Klebsiella spp and 23.00 mm in E.coli, low value was showed in aqueous ginger extract 11.00mm (10µl) followed by 11.33mm (10µl) ethanol extract of garlic against Klebsiella spp and E coli. Indu et al. (2006) suggested that the garlic extract is effective against different serotypes of E.coli. The ethanol extracts showed better results as compared to aqueous as being organic dissolves more organic compounds resulting in the release of greater amount of active antimicrobial components (Cowan, 1999). Among the two spices extracts garlic methanol, ethanol and aqueous extracts increased in the level of concentration of spices extract from 0.2 to 0.6ml increased the growth of E. coli and Klebsiella sp. The minimum inhibitory concentration (MIC) values of different garlic and ginger against bacterial strains range from 0.2mg/ml to 0.8mg/ml. The data in Table 3 & 4 indicated that all test strains were susceptible to garlic and ginger and aqueous and methanol extracts more effective. The decreasing susceptibility of tested pathogenic bacteria was observed in this order: S.epidermidis>S.aureus >B. subtilis>P. aeruginosa>K. pneumoniae = S.typhi> E. coli = Shigella. It was interesting to note that clinical isolates, both Gram negative and Gram positive bacteria were sensitive to all tested extracts of garlic and ginger but Gram positive bacteria were more sensitive than Gram negative bacteria. This result is in accordance with the findings of Chandarana (2005), Onyeagba (2004) and de-Souza (2005).

CONCLUSION

It is concluded from the present study that these spices can be used to produce new therapeutics. Among two spices used garlic was most effective among the ginger so it can be used to develop new antimicrobials. Further research is required to investigate the bioactive molecules of garlic and ginger.

ACKNOWEDGEMENT

The authors express their sincere thanks to Head of the Dept. of Microbiology, Faculty of Science,Annamalai University for providing all facilities and moral support to conduct this work.

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