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Research article

## COMMON HOUSEHOLD SPICES: ALTERNATIVE SOURCE OF ANTIMICROBIAL COMPOUNDS

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**ABSTRACT :** The antibacterial effect of some selected Indian medicinal plants was evaluated on bacterial strains like *Bacillus cereus*, *Bacillus subtilis*, *Bacillus licheniformes* and *Escherichia coli*. The solvents used for the extraction of plants were water, ethanol and methanol. The *in vitro* antibacterial activity was performed by agar well diffusion method. The most susceptible gram-positive bacteria was *B. subtilis*, The aqueous extracts of lemon was found to be effective against all the strains selected while aqueous extract of all other plant extract could not inhibit any of the bacterial strains investigated significantly. The most active antibacterial plant was *Z. officinale Roscoe and Cinnamomum zeylanicum*. The methanolic extracts were found to be more effective than etanolic and aqueous ones.

Keywords: Antimicrobial, solvent extraction, plant extracts.

# INTRODUCTION

The traditional plant have been widely used and known for their medicinal and aesthetic values since ancient times. About 60% of the world's populations exclusively rely on traditional medicinal plants and their extracts for various healthcare needs (Farnsworth, 1994). The use of medicinal plants for their medicinal and food preservative values has carried out since long (Nakatani 1994; Saikia et al., 2001; Chaib et al., 2007 & Park et al., 2008). The medicinal plants are source of great economic value all over the world. The plant extract have been described of having various medicinal properties with antioxidant as an important property (Basaga et al., 1997) as well as used for curing various human diseases (Ryan & Ray, 2004; Wei et al., 2008; Tambekar & Dahikar 2010; Sharmeen et al., 2012). Plant extracts are also reported of having antimicrobial property and used widely as antimicrobial agents (Hsieh et al., 2001; Mahesh and Satish 2008). Several plant extracts and their essential oils have been found of having ability to control microorganisms i.e. both gram negative and gram-positive bacteria related to skin, dental caries and food spoilage (Sartoratto et al., 2004, Reddy et al., 2001 & Ateb et al., 2003). The antimicrobial compounds of medicinal plants have been given much importance due to less side - effects, better patient tolerance, cheap cost and wide range of application. The different parts of plants such as root, stem, flower, fruits, bark and leaves possess varied medicinal properties. Plant extracts are given singly or as concoctions for various ailments. The aim of present study was to evaluate aqueous, ethanol and methanol extracts of the following commonly used plants in food item in different forms i.e. bark of Cinnamomum zevlanicum (dalchini), leaves of Syzygium cumini (Jamun), Ziziphus mauritiana (Beri), Ocimum sanctum (Tulsi), rhizome of Zingiber officinale Roscoe (Ginger), bulb of Allium sativum (Garlic) and fruit Citrus limon (lemon) to screen their anti bacterial activity against both gram positive and negative strains.

# MATERIAL AND METHODS

## Plant material

The plant materials were obtained from local market of Patiala Punjab (India)

## **Preparation of extracts**

For aqueous extracts the plant parts chosen for study were first washed with distilled water and then wiped with 70% ethanol for proper removal of dust and surface microorganisms. Then plant parts used for analysis were sliced into small pieces and were shade dried for 5-6 days to reduce their moisture content.

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After complete drying the pieces were ground with the help of pestle and mortar. Then 20gm of each powder was weighed and dipped in 100ml of sterlised distilled water and allowed to stand for 24 hrs. Then the mixtures were filtered with the help of muslin cloth and the Extracts were stored at  $4^{\circ}$ C for future use. For the preparation of alcoholic extracts i.e. ethanolic and methanolic extracts dried material as prepared for aqueous extracts was grounded with pestle and mortar. Then 20gm of the powdered material were soaked in 100ml of 90% ethanol and methanol respectively and allowed to stand for 24 hours. Afterwards the mixture was filtered with muslin cloth to obtain the crude extracts. All the filtrates were placed on water bath at  $100^{\circ}$ C for evaporation to obtained  $1/4^{\text{th}}$  of the extracts.

#### Screening of antimicrobial activity

The pure bacterial culture of *E. coli*, *B. subtilis*, *B. licheniformes* and *B. cereus* were obtained from IMTECH Chandigarh. For the testing of antibacterial activity the agar well diffusion method (Jain et al. 2009) was adopted. The nutritive medium was prepared by dissolving peptone (1gm), yeast (0.5 gm), NaCl (1gm) and agar(3%) into 100ml distilled water and sterilizing it in an autoclave at  $121^{0}$ C for 15 minutes at 15 psi. Then approximately 25ml of medium was poured into sterile petri dishes. After solidification 100µl of bacterial culture was spread. A well was prepared in the plates with the help of a cork-borer (6mm), 100 µl of the test compound was introduced into the well. The plates were inoculated for 30 minutes in laminar flow for diffusion of extracts and further incubated overnight at 37 °C. Microbial growth was determined by measuring the diameter of zone of inhibition. For each bacterial strain, controls were maintained where pure solvents were used instead of the extract. The result was obtained by measuring the zone diameter.

#### RESULTS

The medicinal plants are popular for treatment infectious diseases as many plant extracts are reported to possess antimicrobial activity. The present attempt has been made to investigate the in vitro potential of C. zeylanicum, S. cumini, Z. mauritiana, O. sanctum, Z. officinale Roscoe, A. sativum and C. limon as antimicrobial agent for the bacterial strains E. coli, B. cereus B. licheniformes and B. subtilis. The alcoholic extracts viz methanolic and ethanolic extracts of garlic, ginger, tulsi, beri and jamun were studied while among aqueous extracts along with these lemon was also studied to evaluate their potential as an antimicrobial agent. The results of antimicrobial screening of plant extracts are represented by Figure 1 & 2. The results indicated that the extracts are potent antimicrobials. The methanolic extracts were found to be more active as compared to ethanolic ones in most of the cases with ginger and cinnamon among the best against all the three gram positive and negative strains. The maximum activity was observed against B. subtilis (16mm) while least was against B. cereus (12mm) and E. coli (11mm). As depicted by results tulsi though common house hold remedy was found to be least effective as compared to other extracts for gram positive strains but its effect was better for ethanolic as compared to methanolic and aqueous extracts. Among various solvent extracts studied, methanol extract showed higher degree of inhibition followed by ethanol. The aqueous extract of C. zeylanicum has shown activity against B. subtilis while that of C. limon has shown anti microbial effect against all the three strains studied whereas the aqueous extracts of other plants did not show any significant effect (Figure 3). The aqueous extract of C. limon showed maximum activity (10mm) against B. subtilis. When compared for the activity of methanol extracts C. zeylanicum showed maximum action (16mm) against B. subtilis followed by A. sativum (11mm), S. cumini (9mm) and Z. mauritiana (8mm) respectively. Against B. cereus maximum activity was shown by methanolic extracts of C. zeylanicum (12mm) while against E. coli ethanolic extracts of it showed maximum activity of (11mm) followed by C. limon (10mm) and A. sativum (9mm). On comparison it was found that the maximum affectivity of Z officinale and C. zeylanicum was there in almost each type of solvent extract as compared to other six chosen plant extracts (Figure 4). Thus different extracts varied the activity level of same material as well as same extract had described variation in its action in different materials.

#### DISCUSSION

The results from present study has evaluated ginger and cinnamon as most effective anti microbial agent as supporting many previous findings (Prabuseenivasan *et al* 2006 and El-Baroty *et al* 2010). The present study depicted methanolic extracts to be better among all the extracts as compared to ethanolic and aqueous ones which are contrary to various workers (Samy, 2005). While certain investigators in confirmation to present results reported ethanolic, methanolic and acetonic extracts of *C. zeylanicum* bark with higher activity than the water extract (Aneja *et al*, 2009).

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Lemon extract was more effective than *O. sanctum* while contrarily some described Ocimum to more effective than lemon (Pandey *et al* 2010). Regarding effective levels recorded as per zone of inhibition the ethanolic extracts of ginger in our study showed an inhibition zone of 12mm against *B. subtilis* whereas, a maximum zone of 9mm (Ekwenye and Elegalan 2005), no effectivity of ethanolic extracts against *Bacillus* species, *S. aureus* and *E. coli*. (Onyeagba *et al* 2004) was previously described. In some findings methanolic extract of ginger was not found to be effective against *S. aureus* and *E. coli*. (Samy 2005). Certain researchers (Srinivasan *et al* 2009) reported aqueous extracts of garlic to be significantly effective against *E. coli*, *B. subtilis* and *S. typhi* while in contrast no such effectivity has been observed. The methanolic extracts studied of garlic recorded widest zone of inhibition of 11mm against *E. coli* and *B. subtilis* while quite less size of maximum inhibition zone of merely 3mm against *E. coli* and 2mm against *B.cereus* was reported (Saravanan *et al* 2010). Thus keeping in view of their effectivity and potential as antimicrobial agent these plants spices and herbs can be used not only for flavoring agents but also used as medicine, food preservatives, pharmaceuticals, alternative medicine and natural therapies.



Figure1: Activity of ethanolic extracts of Cinnamon, Tulsi, Zizipus, Jamun, garlic and ginger



Figure 2: Activity of methanolic extracts of Tulsi, Jamun, garlic and ginger



Figure 3: Activity of aqueous extracts of lemon and Jamun



Figure 4: Antimicrobial profile of various plant extracts (alcoholic and aqueous) against various bacterium

#### CONCLUSION

The various plant extracts show variation in their antimicrobial activity with different solvents. Among the present studied plants *Z. officinale and C. zeylanicum* have been observed as most potent antimicrobial agents. The affectivity of *C. limon* in aqueous extracts was maximum as compared to the other studied extracts. Thus the common house hold spices beside flavor provide essential antimicrobial activity against common bacteria. The effect of studied extracts on these organisms *in vivo* cannot be predicted from this study. Further *in vivo* studies are necessary to describe varied impacts of these plant extracts. More importantly there is need for detailed scientific study of traditional medical practices to ensure that valuable therapeutic knowledge of some plants is preserved and also to provide scientific evidence for their efficacies.

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