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Antimicrobial activity of Tropical Fruits

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ABSTRACT : The present study was designated to study the antimicrobial activities of aqueous and alcohol extracts that were prepared from fresh fruits of *Malus domestica, Punica granatum, Psidium guajava,* and *Citrus sinenses*. The antimicrobial activities of the extracts were tested against bacteria and fungi by the use of agar well diffusion method. The aqueous extracts showed higher antimicrobial activity as compared to alcohol extracts. The aqueous extracts of *M. domestica* were most active against *Candida albicans* with the (MIC = 1.2 cm) and inactive against gram negative bacteria *Escherichia coli.* Gram positive bacteria *Staphylococcus aureus* extracts were found to be most active for *P. guajava* and *P. granatum* with (MIC = 1.1 cm and 1.0 cm respectively), while the alcohol extract of *M. domestica* showed highes antimicrobial activity for gram positive bacteria *Bacillus subtilis* with (MIC = 0.8 cm) and no activity against gram negative bacteria *Pseudomonas aeuroginosa*. Similarly, *P. guajava* and *C. sinensis* showed no activity against gram positive bacteria *S. aureus.*

Keywords : Antibacterial, Antifungal activity, *Malus domestica, Punica granatum, Psidium granatum, Citrus Sinensis.*

INTRODUCTION

There has been renewed interest in screening high plants for novel biologically active compounds, particularly those that effectively intervene the human ailments. There is a great demand of fruit juices in treatment of various illness such as arthritis, heart diseases and muscle aches and drug addiction (Tedesco et al., 2001). Even tens of thousands of antimicrobial compounds exist, the ability of microbes to develop resistance to even the most powerful antimicrobial compounds is amazingly rapid (Jayaraman *et. al.*, 2008).

Extraction of bioactive molecules from medicinal plants facilitates pharmacological studies leading to a synthesis of a more potent drug with a reduced toxicity (Beuchat *et. al.*, 1994, Das *et al.*, 1999). Plant based extracts can be extracted from any part of plant like barks, leaves, fruits, seeds and fruit rinds etc. (Parekh and Chanda ,2007).The activity of various fruit extracts have been tested against various microorganisms like bacteria and fungi (Silvia et al., 2004). Generally Gram negative bacteria are more resistant than Gram positive bacteria (Rabe and Staden, 1997, Kelmanson et al., 2000, Parekh *et. al.*, 2005).

The phytochemical composition varies greatly with the different varieties of apples and there by helps in developing new antimicrobials against various infectious diseases (Bravo et al., 1998, Balakrishnan *et. al.*, 2006, Eberhardt et al., 2000). A different content in polyphenols was also reported by (Florida et al., 2007, Kanner *et. al.*, 1994). The detailed study of *P. granatum* activity against three strains of *E. coli* O157: H7 and other strains of Shiga-like toxin producing strains including *E. coli* O026: H11, *E. coli* O011: NM, and *E. coli* O22. Both the minimum inhibitory concentration (MIC) and minimal bacterial concentration (MBC) of the ethyl acetate and n-butanol fractions from ethanolic extracts of *P. granatum* pericarp were established (Piyawan *et. al.*, 2005). Furthermore, its inhibitory activity against VT production by *E. coli* O157: H7 was investigated (Vasconcelos *et. al.*, 2006).

Medicinal uses of guava have been reported involving gastro enteroentritis, dysentery, wounds, ulcers, rheumatics and toothache (Rathore *et. al.*, 1976). Antimicrobial potentiality of the *P. guajava* was investigated against a few clinically isolated as well as standard microbial cultures. In the present study *P. guajava* extracts in methanol (PME), acetone (PAE) and N, N- dimethylformamide (DMF) (PDE) were investigated at two different concentrations for their antimicrobial potentiality against 91 clinically important microbial strains. PME-500 was active against 70% of the total gram-positive bacteria studied, while PAE-500 and PDE-500 were active against 80 and 50 percent of the studied gram-positive bacteria respectively (Walker *et. al.*, 1994).

All the three extracts showed similar activity profiles against gram-negative bacterial strains studied. They were active against 76.36% of the total gram negative bacteria studied which included 73.68% *Pseudomonas sp.*, 93.75% *E. coli*, and 83.33% Klebsiella sp. and 66.66% of Proteus sp. All of the extracts were inactive against one of the three *Citrobacter sp.* and *Alcaligenes fecalis*, while they were active against *Salmonella typhimurium*. The three extracts showed varying results against the fungal strains. PME-500 was active against 37.5%, PAE-500 was active

against 56.25% and PDE-500 was active against 31.25% of the total fungal strains studied. Antimicrobial activity of guava juice extract against *E. coli* O517:H7 (Nair and Chandra, 2007).

MATERIALS AND METHODS

Test organisms

Bacillus subtilis, Staphylococcus aureus, Escherichia Coli, Pseudomonas aeruginosa, Candida albicans were tested for testing antimicrobial activity.

Preparation of extracts

The method for preparing the extracts is adopted from Clarkson and Bibby, 1969.

Water extract

The fruit is cut and crushed till it attains a roughage state. 5gm of the ground/crushed fresh fruit is mixed with 100 ml of distilled water in a Sohxlet extraction apparatus for 4 hrs at 100°C. Water extract is prepared after running the extract in a Sohxlet.

Preparation of alcohol extract

The fruit is cut and crushed to the roughage extent and 5gm of the crushed or ground fresh fruit is taken mixed with 100 ml of absolute alcohol. The mixture is agitated at room temperature for 8 hrs in a room wrist action shaker. The mixture is allowed to stand for 12 hrs and alcohol is evaporated without heat. The residue is then mixed with 100 ml of distilled water at 80°C. Alcohol extract is prepared.

Assessment of antimicrobial activity

The assessment techniques of antimicrobial properties used during the research work were taken from the papers of Micro dilution assay method by Barry et al,. 1981. Agar well diffusion method by Arora and Kaur, 1999.

RESULTS AND DISCUSSION

Water extract of *Malus domestica* (apple) was found to be most effective against the fungal strain, *C. albicans.* The inhibitory concentration was calculated to be as 1.2 cm. Likewise, the water extract activity of *Psidium guajava* (guava) was calculated maximum against *S. aureus* as 1.1 cm. *Citrus sinensis* (orange) water extract was found to be most effective against *S. aureus* as 1.0 cm and the water extract of *Punica granitum* (pomegranate) was found to be most effective against *P. aeruginosa* as 0.8 cm.

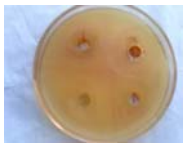

Fig. 1. Antifungal activity of water extract of (L-R) pomegranate, apple, guava and orange against *C. albicans.* Maximum activity can be seen of apple.

Table 1: Comparative study of the water extracts of various fruits against different micro-organisms.

S.No.	*Fruits*	*Gram +ve bacteria*		*Gram –ve bacteria*		*Fungi*
		B. subtilis	*S. aureus*	*E. coli*	*P. aeuroginosa*	*C. albicans*
1.	Apple	1.0 cm	0.7 cm	0.0 cm	0.6 cm	1.2 cm
2.	Guava	0.4 cm	1.1 cm	1.0 cm	0.0 cm	0.4 cm
3.	Orange	0.6 cm	1.0 cm	0.0 cm	0.2 cm	0.8 cm
4.	Pomegranate	0.5 cm	0.7 cm	0.5 cm	0.8 cm	0.5 cm

Alcohol extract of *Malus domestica* (apple) was found to be most effective against the bacterial strain, *B. subtilis.* The inhibitory concentration was calculated to be as 0.8 cm. Likewise, the alcohol extract activity of *Psidium guajava* (guava) was calculated same against *E. coli* and *P. aeruginosa* as 0.5 cm . However, any sort of activity was absent in *B. subtilis* and *S. aureus strains*. *Citrus sinensis* (orange) alcohol extract was found to be most effective against *E. coli* as 0.4 cm and the alcohol extract of *Punica granitum* (pomegranate) was found to be most effective against *C. albicans* as 1.0 cm.

The natural products have relevant advantages over synthetic compounds; they are easily available, comparatively cheaper, can be consumed without any side effects and are also nutritious. I intend to work and conduct comparative study of some tropical fruits like apple, pomegranate, guava and orange as potential antimicrobial and chemoautotrophic agents.

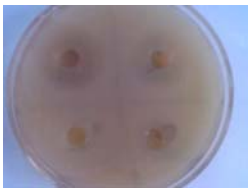

Fig. 2: Antifungal activity of alcohol extract of (L-R) pomegranate, apple, guava and orange against *C. albicans.* Maximum activity can be seen for pomegranate.

Table 2: Comparative study of the alcohol extracts of various fruits against different micro-organisms.

S.No.	*Fruits*	*Gram +ve bacteria*		*Gram –ve bacteria*		*Fungi*
		B. subtilis	*S. aureus*	*E. coli*	*P. aeuroginosa*	*C. albicans*
1.	Apple	1.0 cm	0.7 cm	0.0 cm	0.6 cm	1.2 cm
1.	Apple	0.8 cm	0.4 cm	0.7 cm	0.0 cm	1.6 cm
2.	Guava	0.0 cm	0.0 cm	0.5 cm	0.5 cm	0.3 cm
3.	Orange	0.2 cm	0.0 cm	0.4 cm	0.3 cm	0.0 cm
4.	Pomegranate	0.4 cm	0.6 cm	0.6 cm	0.6 cm	1.0 cm

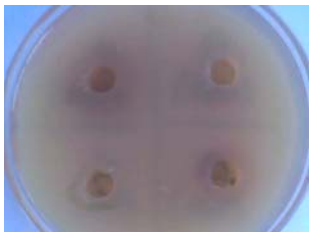

Fig. 3: Antibacterial activity of alcohol extract of (L-R) pomegranate, apple, guava and orange against *P. aeruginosa.* Maximum activity can be seen for orange.

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