



Antimicrobial activity of extracts of *Cinnamomum zeylanicum* bark and its combination with antibiotics against various microorganisms

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ABSTRACT

Various diseases are caused by different pathogenic microorganisms. Antibiotics are used for treatment of infectious diseases, but indiscriminate use of it leads development of resistant microbes. It is required to find new ways to fight against diseases causing microbes. One of them is combination therapy of plant extract with antibiotics and this may be effective for treatment of various diseases. This study has been carried out to evaluate interaction of methanol extract of *Cinnamomum zeylanicum* with different antibiotics against bacteria and fungi.

Key words: *Cinnamomum zeylanicum*, antibiotics, antibacterial, antifungal.

INTRODUCTION

Antibiotics are widely used for treatment of various infectious diseases all over the world. Many antibiotics are becoming failure due to the emergence of multidrug resistant pathogens and the rapid spread of new infections [1]. Some alternative ways are required to fight against diseases causing microorganisms. Due to resistance problem of antibiotics, natural products from plants may be new alternatives. Many plant extracts and phytochemicals are known for their antimicrobial properties [2]. Combination of plant extracts with antibiotics could be a new way to treat various illnesses. Many studies are reported on synergistic effect of plant extract with antibiotics [3].

Cinnamomum zeylanicum (Cinnamon) is a small evergreen tree. It is an important spice and aromatic tree. Leaf and bark are used as spices and for the production of volatile oils [4]. It is used as flavoring agent in the food and beverage industry [5]. Various chemical compounds are present in the different part of *C. zeylanicum*. The principal constituents of leaf, bark and root oils are eugenol, cinnamaldehyde and camphor, respectively [6, 7].

In this study, we have evaluated antimicrobial activity of cinnamon bark extract in combination with different antibiotics.

EXPERIMENTAL SECTION

Collection of plant material

C. zeylanicum bark was collected from local market and authenticated by expert. Bark was grinded to form powder and stored it in airtight bottle till use properly.

Extraction

Powder of *C. zeylanicum* bark was extracted with methanol using soxhlet apparatus. The filtrate was evaporated to dryness. Dry extracts was stored properly till use.

Microorganisms

The following strains were used in the study -

1. *Bacillus subtilis* (MTCC 441) 2. *Escherichia coli* (MTCC 1687) 3. *Pseudomonas aeruginosa* (MTCC 1688) 4. *Staphylococcus aureus* (MTCC 737) 5. *Aspergillus niger* (MTCC 1344) 6. *Candida albicans* (MTCC 81)

Antimicrobial analysis

In vitro antibacterial activity of the extracts and antibiotics was studied by the agar well diffusion method. In case of antifungal activity, the inoculums of test organisms were sprayed on PDA plates. Wells were prepared in the plates using a sterile cork borer of 8.0 mm diameter. The wells were filled with plant extract (100 μ l) and antibiotic drug (100 μ l). In case of combination of plant extract and antibiotic, equal volume (50 μ l) of each was added in the well. The plates were incubated and then zone of inhibition was measured.

RESULTS AND DISCUSSION**Table 1 : Antibacterial activity of methanol extract in combination with antibiotics**

Bacteria	Zone of Inhibition (mm)						
	M.E	Amx	M.E + Amx	Cipro	M.E + Cipro	Eryt	M.E + Eryt
<i>B. subtilis</i>	15	30	35	27	24	23	20
<i>E. coli</i>	12	6	10	28	18	8	10
<i>P. aeruginosa</i>	9	0	7	28	26	2	8
<i>S. aureus</i>	14	30	29	27	24	18	24

ME: Methanol Extract (10mg/mL); Amx: Amoxicillin; Cip: Ciprofloxacin, Eryt: Erythromycin (Conc. of Antibiotics-50 μ g/mL)

Table 2 : Antifungal activity of methanol extract in combination with antibiotics

Fungi	Zone of Inhibition (mm)				
	M.E	Am-B	M.E + Am-B	Fluc	M.E + Fluc
<i>A. niger</i>	13	21	18	0	12
<i>C. albicans</i>	10	10	10	0	8

ME: Methanol Extract (10mg/mL); Am-B: Amphotericin- B; Fluc: Fluconazole, (Conc. of Antibiotics-50 μ g/mL)

Interaction of plant extract with antibiotics as a combination therapy is a novel concept and may be effective for treatment of bacterial and fungal infections [8]. Many studies have reported on combination of plant extract with antibiotic with significant reduction in the MICs of the antibiotics against some resistant strains. Phytochemical from plants (as potential resistance modifying agents) may be responsible for synergistic effect or reduction in the MICs of the antibiotics [9].

Amoxicillin and Ciprofloxacin are effective against various infections which are caused by wide range of Gram-positive and Gram-negative bacteria [10, 11]. Erythromycin is a group of drugs called macrolide antibiotic and useful for the treatment of a number of bacterial infections [12].

Methanol extract of cinnamon showed effective antibacterial activity against tested bacteria (zone of inhibition in range of 9-15 mm). Zone of inhibition of amoxicillin was increased in presence of extract against *B. subtilis* but this combination did not show synergistic effect against other bacteria. Antagonistic effect was observed on combination of ciprofloxacin with methanol extract against all the tested bacterial species. Erythromycin with combination of methanol extract showed effective inhibition against *S. aureus*. Combined activity decreased against *B. subtilis*, *E. coli* and *P. aeruginosa* (Table 1).

Antifungal activity of methanol extract in combination with antibiotics was evaluated against two fungi, *A. niger* and *C. albicans*. Interaction of methanol extract with amphotericin-B resulted in antagonistic effect against *A. niger* and indifferent effect against *C. albicans*. Fluconazole was not showed antifungal activity alone and with plant extract showed activity but it was slightly less or equal to activity of the plant extracts (Table 2).

This study indicates that only amoxicillin and erythromycin with methanol extract exhibited synergistic effect against *B. subtilis* and *S. aureus* respectively. Synergistic effect was not observed in case of antifungal activity.

CONCLUSION

Very few combinations resulted in synergistic effect. Results revealed the importance of plant extract to enhance effective inhibition on combination with antibiotics. Plant extract with antibiotics may be useful to fight against various resistant microorganisms. It is required to carry out more combination with different antibiotics.

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