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ALLICIN AS A DERMAL ANTIBIOTIC AGAINST MICROBIAL INFECTIONS

Ashish Shrivastava and H. K. Garg*

Biotechnology Division, Government Motilal Vigyan Mahavidyalaya, Bhopal - 462008 (India).

*Department of Zoology and Biotechnology Sarojini Naidu Girls Post Graduate (Autonomous) College, Shivaji Nagar, Bhopal – 462016.

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***Correspondence for Author**
Dr. Ashish Shrivastava
Faculty of Biotechnology, Biotechnology Division, Government Motilal Vigyan Mahavidyalaya, Bhopal - 462008 (India).

ABSTRACT

The present study aims to assess the antibacterial potential of allicin against 04 Gram-positive bacterial strains viz. *Staphylococcus saprophyticus, Staphylococcus epidermis, Staphylococcus aureus, Streptococcus pyogenes* and 04 Gram-negative stains - *Proteus mirabilis, Proteus vulgaris, Klebsiella pneumoniae, Neisseria meningitis*, using the Disc Diffusion Method at three concentration; 100, 200 and 300µg/ml respectively in order to treat dermal infections. The results depicted significant antibacterial activity of allicin against both the Gram-positive and Gram-negative bacterial strains. The highest antibacterial activity was noted against *Neisseria meningitis* at 300µg/ml (87 ± 3.5%) and the lowest activity was observed against *Proteus vulgaris* at 300µg/ml (33 ± 2.9%). The Minimum Inhibitory Concentration (MIC) vacillated between 100µg/ml and 200µg/ml depending on the type of microorganism. The results indicated allicin to be an extremely promising herbal medicine for the treatment of dermal infections caused by pathogenic bacterial strains.

KEYWORD: Allicin, antimicrobial activity, dermal infections, MIC.

INTRODUCTION

In recent years, there has been a terrific upsurge in the frequency of dermal infections in developing countries (Marimoto *et al.*, 1999). Human pathogens are difficult to be handled as their drug-resistance capability is augmenting day by day (Garg and Shrivastava, 2013 a, b).

Allicin is a sulphur-containing compound predominantly found in garlic (*Allium sativam*). Allicin is not found, as such, in an unabridged garlic clove. Instead, it is present in the form of alliin. When a garlic clove is crushed or chopped, the cells break down and the alliin comes in contact with an enzyme - alliinase. The alliinase changes the alliin into allicin. This acts as a shielding mechanism for the garlic plant (Cutler and Wilson, 2004). Previous studies have explicitly revealed that allicin has a wide range of pharmacological effects and some of them are tremendously beneficial in diarrhea, fungal, choleric and carcinogenic disorders (Amagase *et al.,* 2001; Staba *et al.,* 2001).

MATERIAL AND METHODS

Anti-bacterial activity of the phytochemical compound - allicin was assessed by culturing bacteria in alternating types of agar and broth based media employing different methods - Zone of Inhibition, Disc Diffusion Method and Turbidometry (Shrivastava and Garg, 2014).

Allicin

A 5000µg/ml aqueous solution of allicin was procured from Allicin International. The purity of the product was confirmed using Thin Layer Chromatography (TLC). Different working concentrations (100, 200 and 300µg/ml) of allicin and gentamycin antibiotic were prepared using simple dilution method (Shrivastava and Garg, 2014).

Microorganisms

Eight different species of bacteria, (04 gram positive; *S. saprophyticus, S. epidermis, S. aureus, S. pyogenes)* and 04 gram negative; (*P. mirabilis, P. vulgaris, K. pneumonia, N. meningitis)* were used in the present study. All bacterial strains were collected from Blossom Pharma and Biotech Research Centre, Bhopal. The test organisms were sub-cultured at 37^{o}C for 24 hours and maintained on nutrient agar media.

Screening for Antibacterial Activity

The agar Disc Diffusion Method was employed for the determination of antibacterial activities of the allicin. Sterile antibiotic discs (Hi-media) were taken and filled up with 100, 200 and 300 µg/ml of allicin and gentamycin using micropipette. At the same time, safety measures were taken to protect the flow of the allicin solution from the outer surface of the disc. The disc were placed on the Mueller Hinton agar plates on which the bacteria were inoculated, spread and plates were then allowed to stay for 1 hour at room temperature under laminar air flow cabinet and finally incubated at 37^{o}C for 24 hours. The assessment of

antibacterial activity was based on the measurement of diameter of inhibition zone (mm) around the disc. The experiment was carried out in five replicates under homogenous conditions and the mean value of percentage inhibition was presented. Gentamycin was used as positive control.

RESULTS

Antibacterial sensitivity of bioactive compound allicin against 04 gram positive strains of bacteria; *S. saprophyticus, S. epidedrmis, S. aureus, S. pyogenes* and 04 gram negative; *P.mirabilis, P.vulgaris, K. pneumonia, N. meningitis* have been presented in Table-1. Allicin is moderately inhibitive to all strains but highly effective against *Staphylococcus saprophyticus* and *Neisseria meningitis.* The compound showed the highest inhibitory action (87 ± 3.5% and 79 ± 2.9%) against *Neisseria meningitis* and *Staphylococcus saprophyticus* respectively at 300µg/ml concentration.

Table - 1: Cytotoxic potential of allicin against 08 different strains of bacteria.

Pathogens	Control	100 µg/ml	200 µg/ml	300 µg/ml
Staphylococcus saprophyticus	82 ± 2.5	31 ± 1.7	43 ± 2.0	79 ± 2.9
Staphylococcus epidermis	78 ± 1.9	23 ± 1.5	33 ± 1.8	61 ± 2.0
Staphylococcus aureus	74 ± 1.5	22 ± 1.1	29 ± 1.0	56 ± 1.8
Streptococcus pyogenes	87 ± 2.8	38 ± 2.1	40 ± 2.6	59 ± 3.0
Proteus mirabilis	55 ± 2.3	36 ± 5.2	54 ± 3.9	70 ± 2.8
Proteus vulgaris	60 ± 4.9	12 ± 2.0	26 ± 2.2	33 ± 2.9
Klebsiella pneumonia	91 ± 4.2	43 ± 2.6	56 ± 4.9	67 ± 5.6
Neisseria meningitis	34 ± 5.4	32 ± 2.4	76 ± 4.8	87 ± 3.5

Control = Gentamycin, value are mean of percentage inhibition with ± SD (n = 5).

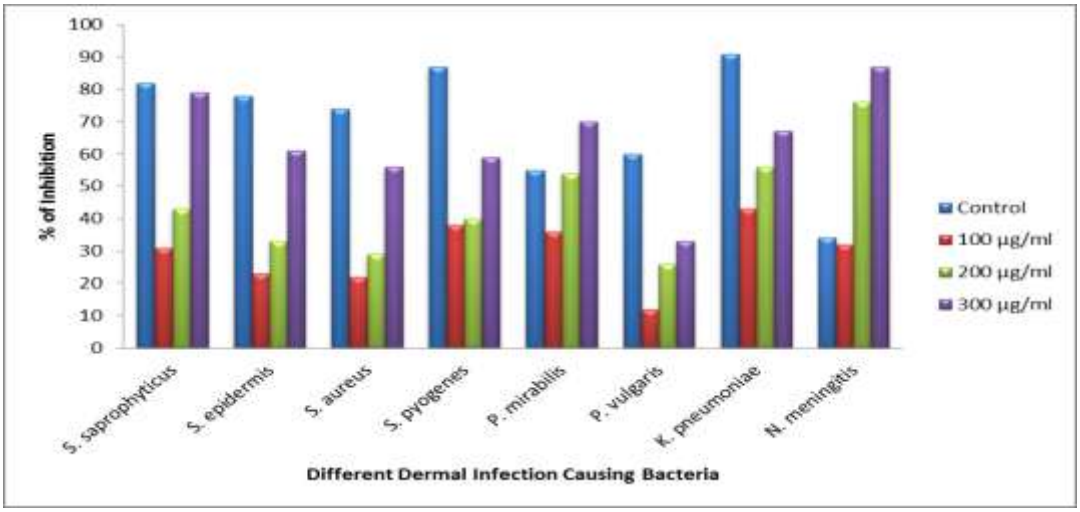

Figure 1: Cytotoxic potential of allicin against 08 different strains of bacteria.

DISCUSSION

Several antibacterial compounds have been isolated from plants, fungi and marine organisms. Over 350 natural products of plant species have been used in traditional medicine (Lewis, 1999; Pauli *et al.*, 2005). Allicin is a herbal medicine and is used for therapy of gut infection, abdominal pain and enteritis (Mach, 2006; Zhanel *et al.*, 1991). Garg & Shrivastava (2013 c) conducted *in-vitro* antibacterial activity of allicin against *E. coli*, *P. vulgaris* and *H. pylori.* They found that allicin is moderately inhibitive to *E. coli*, *P. vulgaris* but highly effective to *H. pylori.* It showed highest inhibition (13 mm) at 500µg/ml concentration against *H. pylori.* In the present study, *in-vitro* antibacterial activity of allicin against the pathogenic bacteria showed enormous inhibitory activity against *Neisseria meningitis* and *Staphylococcus saprophyticus.*

From the fore going account, it is evident that allicin offers a novel broad spectrum of antibiotic activity against dermal infections too.

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