ORIGINAL ARTICLE

Study of Comparison of Antibacterial Activity of Allicin with Antimicrobials against Pseudomonas Aureginosa and Staph Aureus

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ABSTRACT

Objective: This study was designed to compare the antibacterial activity of allicin with other antimicrobials against pseudomonas aureginosa and staph aureus.

Study design: The study was carried out on 50 microorganisms involved in various infection, pseudomonas were obtained from the culture specimens of urine and pus from external ear infections. Staph were taken from throat swabs and skin infections from Sir Ganga Ram Hospital.

Materials and methods: Twenty five strains of staph aureus and twenty five strains of pseudomonas aureginosa were taken. The sensitivity of allicin (1:50) dilution against both strains of microorganisms was compared with the sensitivity pattern of antibiotics ciprofloxacin and clarithromycin against
the same strains.

Result: The results revealed that sensitivity of ciprofloxacin was more than that of allicin against pseudomonas aureginosa but the sensitivity of allicin was more than that of clarithromycine against staph aureus.

Conclusion: It was concluded from this study that, although bacteriostatic activity of allicin is reported but it shows bactericidal activity against the strains of gram +ve and gram –ve microorganisms.

Key words: Allicin, ciprofloxacin, clarithromycin, antibacterial activity.

INTRODUCTION

The antibiotics were discovered around the time of the Second World War. Since antibiotics came into general use in the 1950s, they have transformed the pattern of disease and death. Overtime, heavy use of antibiotics in patients hastens the mutations in bacteria that bring about drug resistance. More than 70% of the bacteria that cause hospital -acquired infections are resistant to at least one of the drugs most commonly used to treat them[1].

Herbal medicine is the oldest form of healthcare known to mankind. The World Health Organization (WHO) estimates that four billion people, 80% of the world population, presently use herbal medicine for some aspect of primary health care[2,3].

Allicin, an active ingredient of garlic, possesses a range of antimicrobial and antifungal properties. It is found that plant enzyme alliinase and its substrate alliin, generate allicin[4] Allicin has been isolated and characterized.

Allicin in its pure form was found to exhibit i) antibacterial activity against a wide range of Gram-negative and Gram-positive bacteria, including multidrug-resistant enterotoxicogenic strains of Escherichia coli; ii) antifungal activity, particularly against Candida albicans; iii) antiparasitic activity, including some major human intestinal protozoan parasites such as Entamoeba histolytica and Giardia lamblia; and iv) antiviral activity.

The main antimicrobial effect of allicin is due to its chemical reaction with thiol groups of various enzymes, e.g. alcohol dehydrogenase, thioredoxin reductase, and RNA polymerase, which can affect essential metabolism of cysteine proteinase activity involved in the virulence of E. histolytica[5,6].

Present study was designed to compare the anti-bacterial activity of allicin with antibacterials like ciprofloxacin, and clarithromycin against microorganisms pseudomonas aeruginosa and staph aureus.

MATERIALS AND METHODS

The antimicrobial discs (Ciprofloxacin) were purchased from the Highnoon Laboratories and discs (Clarithromycin) were purchased from Abbott Laboratories Pakistan.

- The Medias were purchased from Oxoid laboratories.

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- Test material (Allium Sativum) was purchased from local market and its active compound Allicin was isolated from PCSIR laboratories Lahore.
- The culture specimens were obtained from microbiology laboratory (pathology dept.) FJMC, Lahore.
- Allicin was disolved in nutrient broth with dilutions of 1:50, 1:80, 1:120
- The sensitivity of antibiotics Ciprofloxacin and Clarithromycin against twenty five strains of gram negative (Pseudomonas aureginosa) and twenty five strains of gram positive (Staph aureus) respectively was noted. The sensitivity of allicin (1:50 dilution) against strains of gram positive (Staph aureus) and of gram negative (Pseudomonas aureginosa) respectively was also noted and compared with the sensitivity pattern of antibacterials.

RESULTS

Table 1: Sensitivity pattern (mm) of Allicin (1:50 dilution) and its comparison with the sensitivity pattern (mm) of Ciprofloxacin against gram negative Pseudomonas aureginosa.

Herb/drug	Mean (mm)	Minimum (mm)	Maximum (mm)	Standard Div	P-value
Allicin	1.46	0.5	2.0	0.42	N.S
Ciprofloxacin	1.87	00	3.0	0.89	

N.S= No significant difference

Table 2: Sensitivity pattern (mm) of Allicin (1:50 dilution) and its comparison with the sensitivity pattern (mm) of Clarithromycin against gram positive Staph aureus.

Herb/drug	Mean (mm)	Minimum (mm)	Maximum (mm)	Standard Div	P-value
Allicin	1.32	0.2	2.5	0.58	N.S
Clarithromycin	1.16	00	2.5	0.90	

N.S= No significant difference

From these tables it was observed that mean zone of inhibition of gram –ve pseudomonas aureginosa was more by ciprofloxacin as compared to allicin. But this shows nosignificant difference. Correlation coefficient (r value) between the values of inhibition zones of allicin and ciprofloxacin was also calculated and graph of regression analysis showed an inverse relationship(r=o.4206).

The mean zone of inhibition of gram +ve staph aureus was more by allicin as compared to clarithromycin. Correlation coefficient (r value) between the values of inhibition zones of allicin and clarithromycin was also calculated and graph of regression analysis showed direct relationship (r=0.2222) between the sensitivity of allicin and clarithromycin against staph aureus.

DISCUSSION

In the present study we noted that Pseudomonas aureginosa are more sensitive to ciprofloxacin than allicin because ciprofloxacin has a broad antibacterial spectrum of activity against gram-positive, gram-negative and mycobacterial pathogens as well as anaerobes. They also show good to moderate oral absorption and tissue penetration with favorable pharmacokinetics in humans resulting in high clinical efficacy in the treatment of many kinds of infections. This study is consistent with the previous study by (Chin Neu 1987, Ismaeel Tayeb 1993, Orret 2004)[7,8,9].

Our study is also in accord with Celodner et al (2001)10 according to this study ciprofloxacin has an excellent post antibiotic suppressive effect for most of gram negative bacteria. So less frequent dosing is required for the treatment of tissue and urinary infections (Chin 1987). Following the release of ciprofloxacin in the United States in 1987, resistance of ciprofloxacin began to be noted among highly susceptible species such as E-coli and among less susceptible species such as pseudomonas aeruginosa.

According to a study conducted by Morton (2000)[11] it was reported that resistance mechanisms have involved either of two mechanisms i.e. altered target enzymes with reduced affinity of mutant enzymes-DNA complexes for fluoroquinolones due to mutations in the gyrase. He observed that this mutation is in the subunit of Topoisomerase IV or altered drug permeation to the target site in gram-negative bacilli due to reductions in porin proteins and also may be due to energy requiring efflux systems.

Antibacterial activity of allicin was proved by Lee et al (2003)[12]. He proved that allicin has activity against methicillin and Ciprofloxacin- resistant staphylococci, vancomycin, resistant enterococci and ciprofloxacin resistant pseudomonas aureginosa.

(Sovova and Sova in 2002)[13] summarized the experimental findings confirming the antibacterial effect of allicin. A number of studies agreed with these findings and suggested that the number of sulphur atoms/molecules and/or disulphide bonds in these diallyl sulphides was an important factor in determining their antimicobial activities (Naganawa et al 1996,Chen et al 1999, Gara et al 2000,)[14,15,16]

Comparison of antibacterial activity of allicin and clarithromycin was done against staph-aureus. In this study mean zone of inhibition of allicin was more as compared to the mean zone of inhibition of clarithromycin but this shows no significant difference. The azalide antibiotic clarithromycin can be regarded as advanced-generation macrolide as compared with erythromycin. The spectrum of activity of macrolides comprises gram-negative atypical and upper respiratory anaerobic pathogens (Amsden, 2001)[17]. There is no study reported about the comparison of allicin and clarithromycin against staph aureus.

CONCLUSION

On the basis of the data obtained from the present study, it may be concluded as under:
"Allicin showed significant antibacterial activity against pseudomonas aureginosa and staph aureus. Which shows that, although, bacteriostatic activity of allicin is reported but it may show bactericidal activity against the strains of gram-positive and gram-negative microorganisms".

Antibacterial activity of allicin alone was less than ciprofloxacin against pseudomonas aureginosa. This may explain that the antibacterials which are recently introduced in pharmaceutics have potent bactericidal effects as compared to allicin.

Finally we may conclude that due to increasing resistance of current and old antibiotics, it may be suggested that the use of allicin along with antibiotics may overcome the resistance developed by microorganisms. However further research is needed in vivo as well as in vitro to reach a better conclusion.

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