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Research Article

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Efficacy of antimicrobial activity of aqueous garlic (*Allium sativum*) extract against different bacterial species

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ABSTRACT

As per the World Health Organization, the Antibiotic resistance is a serious threat is no longer a prediction for the future and has emerged as one of the preeminent public health concerns of the 21st century. In recent days, natural source have replaced the commercial drugs. Many medicinal plants are used as source of alternative medicine for treating various diseases. Allium sativum (Garlic) is well known for its medicinal uses. The efficacy of antimicrobial activity of fresh Garlic extract was tested against bacterial cultures such as Escherichia coli, Staphylococcus aureus and Pseudomonas aeruginosa at different concentration of garlic extract by disc diffusion method. The results of this assay showed thatthe zone of inhibition of 50% garlic extract against Staphylococcus aureus and Pseudomonas aeruginosa was morewhen compared to Escherichia coli. In conclusion, 50% aqueous garlic extract can be used as an effective antimicrobial agent against Staphylococcus aureus and Pseudomonas aeruginosa.

Key words*: Allium sativum,*antimicrobial activity, disc diffusion method, Medicinal plants, Alternative medicine

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INTRODUCTION

The use of various antibiotic drugs has controlled the increasing Microbial Pathogenicity and infectious diseases [1].But over the last few decades there is an increase in the use of natural source as alternate medicine for the treatment of diseases [1].This is owing to natural products have least adverse events [1].Many medicinal plants is documented to have antimicrobial activity [2].Among which *Allium sativum*(Garlic)belonging to Alliaceae family,apart from cookingis also known for its medicinal values [3].It is more commonly used in Eastern Europe and Asia (4).It isused in many forms like whole garlic, garlic oil and garlic powder for various medicinal purposes over decades [4]. It mainly helps in preventing tumor, cardiovascular disorders, liver damage, aging [5] and also lowers blood pressure, blood sugar and blood cholesterol [6].Garlic is documented to have antioxidant activity *in vivo* [5,6]. Garlic has the power of killing and inhibiting the growth of pathogens and microorganisms like bacteria and fungi thus it is said to have antimicrobial activity [5,6].However, the efficacy of aqueous garlic extract is poorly documented. Hence, the present study aimed to evaluate the efficacy of antimicrobial activity of aqueous garlic extract against various microorganisms like *Escherichia coli, Staphylococcus aureus* and *Pseudomonas aeruginosa.*

EXPERIMENTAL SECTION

Maintenanceof the bacterial cultures

One Gram positive bacteria (*Staphylococcus aureus*) and Two Gram negative bacteria (*E.coli* and *Pseudomonas aeruginosa*) were obtained in the form of liquid cultures from Microbiology Laboratory of the Department of Biotechnology, Periyar Maniammai University, Vallam, Thanjavur, Tamil Nadu, India.

Preparation of aqueous garlic extract

Garlic (*Allium sativum*) species were purchased from local market. 50g of peeled garlic was weighed and washed with sterile distilled water by soaking for 5 minutes and then it was soaked in 95%ethanol for 3 minutes to make the species sterile. Then the garlic was dried for 10 minutes to evaporate the ethanol. Then the dried garlic was crushed in sterile mortar and pestle by adding 0.5ml of distilled water. After mashing the garlic will be in a paste form, it is filtered using Whatman no. 1 filter paper and the extract collected was 15 ml. This extract was considered to be 100%. Different concentrations of the extract (50% and 20%) were prepared by diluting with appropriate volume of distilled water. The prepared different concentration of the extract was stored in the refrigerator till use.

Preparation of culture plate(Agar plate)

7g of nutrient agar was weighed and mixed with 250ml of water. The agar solution is sterilized in pressure cooker. Then the agar is poured in 9 sterile petri plates and it is allowed to solidify. After solidifying, in 1st three plates E.coli culture of 100µl each was poured in the plate by spread plate method. In the next three plates 100µl of Pseudomonas aeruginosa culture and in the remaining plates 100µl of Staphylococcus aureus were added in the same way. Then the culture is allowed to grow for 24 hours in 38ºc.

Preparation of antibiotics

The antibiotics ciproflaxin and ampicillin 500mg each were purchased in the form of capsules from the local medical shop.These antibiotics were diluted based on the concentration of the sample (20% and 50%).

Disc diffusion method

The discs were made using Whatman no. 1 filter paper with the help of punching machine. The disc was first dipped in 20% of the sample and placed in the respective plates using sterile forceps. Then another set ofdisc was taken and dipped in 20% of the antibiotic and placed in another edge of the same plate where the sample is placed using sterile forceps. The same way the disc was dipped in 50% of the sample and 50% antibiotics and placed in their corresponding plates. The discs with antibiotics should be placed on the corresponding bacterial culture plates. The plates were incubated in 38ºc for 24 hours.After incubation of 24 hours the zone formed around the disc was observed in the plates. The diameter of the zone was measured in millimeter.

RESULTS AND DISCUSSION

From this assay it is noted that the efficacy of 50% garlic extract against *Staphylococcus aureus* is more when compared to the (ampicillin) antibiotic at 50% concentration (Fig.A). At 20% concentration the efficacy of garlic extract is less against *Staphylococcus aureus* when compared to 20% antibiotic (ampicillin).Thus the antibacterial effect of garlic extract against *Staphylococcus aureus* at 50% concentration is more compared to 20% concentration. Same way 50% of garlic extract against *Pseudomonas aeruginosa* showed better zone compared to 50% of antibiotic (ciprofloxacin)(Fig.B). But 20% of both garlic extract and antibiotic showed no result against *Pseudomonas aeruginosa*. So the efficacy of antibacterial activity of garlic extract against *Pseudomonas aeruginosa* at 50% concentration is more compared to 20% concentration. The antibacterial activity of garlic extract against *E.coli* showed no results for both 50% and 20% of the garlic extract. Whereas the efficacy of both 20% and 50% antibiotic (ciprofloxacin) showed better results against *E.coli* compared to garlic extract (Table).

Table: Zone of inhibition of the antibiotics and aqueous garlic extract in Different concentrations

Test organisms	Antibiotics	Diameter of the zone (mm) in the Antibiotic of concentration		Diameter of the zone (mm) in the sample of concentration	
		50%	20%	50%	20%
Staphylococcus aureus	Ampicillin	6mm	5mm	10mm	3mm
Pseudomonas aeruginosa	Ciprofloxacin	7mm	-	9mm	-
Escherichia coli	Ciprofloxacin	10mm	10mm	0	0

Bacteria are some of the major source of infections and diseases in humans. Though there are several commercial medicines available, the natural sources have showed the best result in inhibiting the bacterial growth. One such natural source *Allium sativum* (garlic) extract showed better antibacterial activity against *Staphylococcus aureus and Pseudomonas aeruginosa.Staphylococcus aureus*is one of the major bacteria that cause skin infections such as abscesses (boils), furuncles, and cellulitis etc.

Figure: Zone of inhibion of the 50% concentration antibiotic and aqueous garlic extract

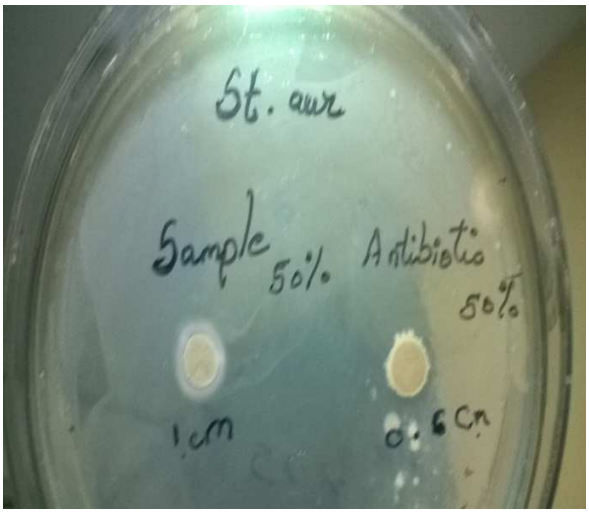

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Figure A: Zone of inhibition in Staphylococcus aureus ***Figure B: Zone of inhibition in Pseudomonas aeruginosa***

Garlic extract showed better activity against Gram positive organisms *than* Gram negativeorganisms. This is may be due to Gram positive bacteria have thick structural constituents which increase the interaction of active molecules of garlic that will inhibit the*Staphylococcus aureus*as reported in the previous study[7]. To prevent these infections, the growth ofsuch microbes should be inhibited. The presence of active components and alkaloids can be identified by further GCMS analysis.

CONCLUSION

The result of the present study have shown that the 50% aqueous extract of *Allium sativum*(Garlic) havehighly efficient as an antimicrobial agent in the treatment of infectious organisms namely *Staphylococcus aureus* and *Pseudomonas aeruginosa. Further* studies are needed to conform our results and also investigation of the active components of the *Allium sativum*extract which is responsible for antimicrobial activity.

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