

Antimicrobial activity of garlic extract on oral pathogens

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ABSTRACT

Background: In the ancient time, many naturally occurring plants played an important role, in discovery in many therapeutic agents. It has been shown to have a beneficial role such as therapeutic uses which include beneficial effects on the cardiovascular system and antibiotic, anticancer, anti-inflammatory, and hypoglycemic effects. Garlic has major part. Garlic is also known as *Allium sativum* Linn. Human oral cavity has >500 species of bacteria of dental plaque. Despite the garlic extract has been shown to have antimicrobial property, its effects of selected on human oral pathogens are yet to be identified. **Objectives:** The objectives of this study were to estimate the antimicrobial activity of garlic extraction on oral pathogens on *Enterococci* and *Streptococcus mutans*. **Materials and Methods:** Garlic extract will be proceeded from the local market and used for the present investigation. The extract will be mixed with distilled water 1 mg/ml concentration. Then, 10, 20, 30, 40, and 50 ml volume of extract will be loaded on agar well diffusion method to sterile discs with respective organisms of oral pathogens. Then, the antibacterial activity will be studied separately. After 24 h incubation period, the plates will be observed and inhibition zone was recorded as minimal inhibitory concentration. **Results:** The investigation of antibacterial activity of garlic extract Gram-positive bacteria such as against *Enterococci* and *S. mutans* was done by agar well diffusion method. Mean zones of inhibition of different concentrations were measured and compared with the control. In this study, garlic extract dose dependently increased the bacterial growth inhibition. However, 100% inhibition was observed against *Enterococci* and *S. mutans* than the standard drug ciprofloxacin. Finally, the extract showed a potential antibacterial activity. **Conclusion:** Based on the results recorded in the present findings, it was concluded that garlic extract has a potential antimicrobial agent on human oral pathogenic microorganisms, and hence, the herbal drug may serve as one of the potential antimicrobial agents.

KEY WORDS: Agar, Bacterial growth, *Enterococci*, Garlic extract, *Streptococcus mutans*

INTRODUCTION

With the rise in bacterial resistance to antibiotics, there is a considerable interest in the development of other classes of antimicrobials for the control of infection. Garlic (*Allium sativum*) has been used as a medicine since ancient times and has long been known to have antibacterial, antifungal, and antiviral properties.^[1] The aim of this study was, therefore, to investigate the antimicrobial effect of garlic extract against a range of oral microorganisms, including periodontal pathogens, and to determine its effect on the cysteine proteases of *Porphyromonas gingivalis*.^[2] Allicin reacts very rapidly with free thiol groups, through thiol-disulfide exchange, and therefore, it is

thought that its main mechanism of antimicrobial action is through interaction with thiol-containing enzymes, including cysteine proteases and alcohol dehydrogenases.^[3] Allicin is the precursor of sulfur-containing compounds, which are responsible for the flavor, odor, and pharmacological properties. Once exposed to air, allicin is further converted into diallyl disulfide, which has antibacterial effects, and the reduction by cysteine will disrupt the disulfide bond in microbial proteins.^[4] Bacterial growth inhibition and bactericidal properties are mainly attributed to allicin and thiosulfonates.^[5] Bacterial growth inhibition and bactericidal properties are mainly attributed to allicin and thiosulfonates found in garlic but other sulfur-containing compounds, such as ajoene, also decrease bacterial growth.^[6] Pure garlic extract had more efficient antimicrobial properties than tetracycline against human-cecum bacteria.^[7]

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Table 1: Antibacterial activity of Garlic extract on Gram-positive bacteria

Concentration of extracts	Zone of inhibition (mm in diameter)		Percentage of zone inhibition (%)	
	<i>Enterococci</i>	<i>S. mutans</i>	<i>Enterococci</i>	<i>S. mutans</i>
50 µg/ml	22 mm	19 mm	88	82.60
100 µg/ml	23 mm	21 mm	92	91.30
150 µg/ml	25 mm	23 mm	100	100
Ciprofloxacin	26 mm	30 mm	81.25	93.75

S. mutans: Streptococcus mutans

MATERIALS AND METHODS

Test Microorganisms

Bacterial strains used were multidrug-resistant *Enterococci* and *Streptococcus mutans*, and they were obtained from the Department of Microbiology, Saveetha Dental College, and maintained in nutrient agar slope at 4°C.

Collection of Plant Material

The whole plants of garlic extract were collected in fresh condition from Chennai region, Tamil Nadu. The voucher specimens of the plants were authenticated by the department. The screening of antibacterial activity of the garlic ethanolic extract was carried out using the agar well diffusion method. The bacterial strain was inoculated into nutrient broth and incubated at 37°C overnight. The culture was then adjusted to 0.5 McFarland turbidity standard. 23–26 lawn culture of the test organism was made on the Mueller Hinton agar (MHA-HiMedia M1084) plates using a sterile cotton swab, and the plates were dried for 15 min. A sterile cork borer was then used to make wells (6 mm diameter) for different concentrations of the extracts. 100 µl of the varying concentrations (50, 100, and 2000 µg/ml) of the extracts were introduced into the wells with the help of micropipettes. The culture plates were allowed to stand on the working bench for 30 min for pre-diffusion and were then incubated in the upright position at 37°C for 24 h. After 24 h, antibacterial activity was determined by measurement of the diameter of zones of inhibition (mm). Standard antibiotic discs of ciprofloxacin (30 mcg/disc) were used as positive control. All the tests were done in triplicate to minimize the test error.

Statistical Analysis

The data were subjected to statistical analysis using one-way analysis of variance and Duncan's multiple comparison test to assess the significance of individual variations between the control and treatment groups using a computer-based software (SPSS 7.5 using Windows Student Version). The significance was considered at the level of $P < 0.05$.

RESULTS

The investigation of antibacterial activity of garlic extract Gram-positive bacteria such as against

Enterococci and *S. mutans* was done by agar well diffusion method. Mean zones of inhibition of different concentrations were measured and compared with the control. In this study, garlic extract dose dependently increased the bacterial growth inhibition. However, 100% inhibition was observed against *Enterococci* and *S. mutans* than the standard drug ciprofloxacin. Finally, the extract showed a potential antibacterial activity.

DISCUSSION

Oral bacteria exhibit highly specific adherence mechanisms, and as a result, they colonize and cause disease principally in the oral cavity. Garlic (*A. sativum*) is a plant from the Liliaceae family, which is present in Central Asia and can be found today in all parts of the world.^[8] From centuries ago, different species of this plant were used as a spice and food additive in cooking and also applied as a drug in herbal medicine for the treatment of various types of diseases.^[9] Garlic is known to have antibacterial, antifungal, and antiproteolytic activity.^[10] In this description of an assessment of its activity against a wide collection of oral organisms and in particular against putative periodontal pathogens. Mouthwash containing garlic extract has good *in vivo* activity against the salivary mutans streptococcal and total bacterial viable counts, although no direct assays have been performed on oral biofilms.^[11] Garlic extract has, however, been reported to inhibit the formation of biofilms.^[12] In the present study, garlic extract dose dependently increased the bacterial growth inhibition. However, 100% inhibition was observed against *Enterococci* and *S. mutans* than the standard drug ciprofloxacin. Finally, the extract showed a potential antibacterial activity.

CONCLUSION

The use of herbal medicine is increasing with the increase in the development of drug resistance among bacterial population. Herbal medicines are safe with no side effects and have significant action against bacteria and other microorganisms. Based on the results recorded in the present findings, it was concluded that garlic extract has a potential antimicrobial agent on human oral pathogenic microorganisms, and hence, the herbal drug may serve as one of the potential antimicrobial agents. Further studies on the isolation of active principles from the plant are needed.

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