

Antimicrobial Activity of *Ulva lactuca*, Green Algae, against Common Oral Pathogens

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ABSTRACT

Introduction: Marine algae with their ability to synthesize bioactive secondary metabolites and excellent antimicrobial efficacy provide an alternative to chemical based antibiotics. *Ulva lactuca*, green algae with various phytochemicals and sulfated polysaccharides, possesses antimicrobial efficacy. This present study tested the antimicrobial activity of *Ulva lactuca*, green algae, against common oral pathogens.

Materials and methods: *Ulva lactuca* was collected from the Gulf of Mannar, and 1% of *Ulva lactuca* extract was used for antimicrobial activity. The agar well-diffusion method was used to determine the antibacterial activity of different concentrations of *Ulva lactuca* aqueous extract against oral pathogens, such as *Streptococcus mutans*, *Lactobacillus*, and *Staphylococcus aureus*.

Results: The mean zone of inhibition (ZOI) was found to be same, 8 mm in diameter, across all concentrations (25, 50, and 100 µL) of the extract. The extracts showed only moderate antimicrobial activity compared to that of control antibiotic used.

Conclusion: The present study showed that aqueous extracts of *Ulva lactuca* had only moderate antimicrobial activity compared to the commercial antibiotics.

Keywords: Anti-bacterial agents, Mouth, Seaweed.

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INTRODUCTION

Marine environment is an excellent source of biologically active natural products that contain a vast range of organisms with distinctive biological properties.¹ Marine organisms are the least explored and underutilized biological resources. Marine organisms such as bacteria, protozoans, plants, and animals have shown excellent beneficial biological properties that could be used for health benefits. Seaweeds are classified as marine macroalgae, and they are further classified into brown algae (Phaeophyta), red algae (Rhodophyta), or green algae (Chlorophyta).² Seaweeds have abundance of novel bioactive compounds, which is unique and has excellent health benefits.

In the recent times, there has been increase in infectious disease and irrational use of antibacterial based on chemical combination. This has led to increased incidence of resistant microorganisms.³ Therefore, it has become important to explore new antimicrobial compounds from natural sources, such as plants and other biological alternatives.

Marine sources such as macroalgae and seaweeds provide an excellent alternative with their inexhaustible availability and their ability to synthesize bioactive secondary metabolites.⁴ Various studies have shown marine algae to possess antibacterial, antiviral, antifungal, antiallergic, and anticancer properties.⁵⁻⁹ Green algae, *Ulva* spp, is documented to have antimicrobial activity against major pathogens such as *Staphylococcus aureus* and even MRSA. This shows the opportunity to test it against common oral pathogens that cause dental caries like *S. mutans*, *S. aureus*, and *Lactobacillus* spp. Only one previous study¹⁰ is documented to have tested the anti-microbial efficacy of *Ulva lactuca* against oral organisms. Hence, this study is conducted to test the antimicrobial activity against oral pathogens.

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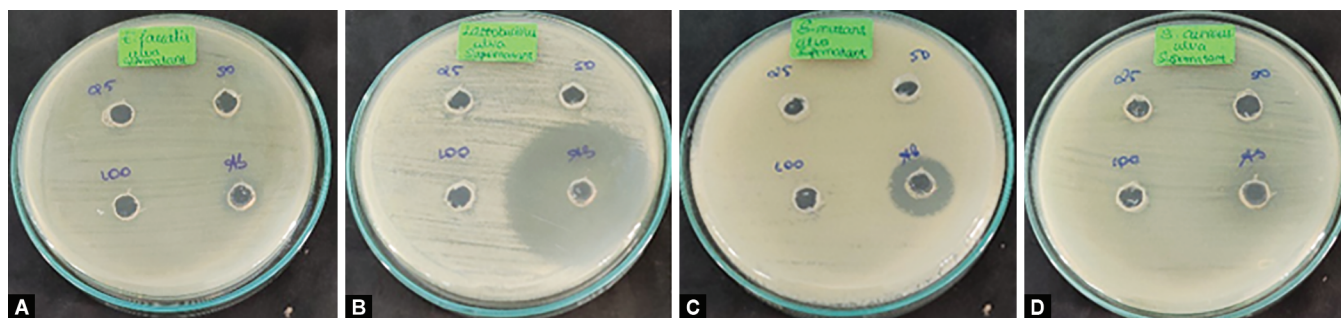
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MATERIALS AND METHODS

Ulva lactuca was collected from the Gulf of Mannar Biosphere in Mandapam, Rameswaram. The taxonomic identification was done by senior marine biologist using standard literature and taxonomic keys. The collected algae were washed in tap water, shade dried, and stored in dry dark place at room temperature. 1% of the *Ulva lactuca* extract was prepared by boiling 10 g of the algae in 100 mL of double distilled water in a water broth at 70°C



Figs 1A to D: Anti-microbial activity aqueous extracts of *Ulva lactuca* against common oral pathogens

for 10 minutes. Whatman number 1 filter paper was used to filter the solution following boiling, and the obtained filtrate was used for antimicrobial activity.

The agar well-diffusion method was used to determine the antibacterial activity of different concentrations of *Ulva lactuca* aqueous extract against oral pathogens such as *Streptococcus mutans*, *Lactobacillus*, and *Staphylococcus aureus*. Different concentrations of AgNPs against oral pathogens. The microorganisms, namely, such as *Streptococcus mutans* (MTCC 497), *Lactobacillus* (MTCC 10307), and *Staphylococcus aureus* (MTCC 3103) were procured from Institute of Microbial Technology, Chandigarh, India. Secondary cultures of microbial suspension was dispersed evenly on the surface of Muller Hinton agar and rose Bengal agar plates using a sterile spreader. Different concentration of the extract (25, 50, and 100 µL) were incorporated through a sterile micropipette into the wells created on the agar plate using sterile cork borer. The plates were then incubated at 37°C for 24 to 48 hours. Commercial antibiotic ampicillin (50 mg/mL) was used as positive control, and the zone of inhibition (mm) was recorded for each plate and compared to control.

RESULTS

Antimicrobial efficacy of different concentrations of aqueous *Ulva lactuca* extracts are presented in Figure 1. The mean zone of inhibition (ZOI) was found to be same 8 mm in diameter across all concentrations (25, 50, and 100 µL) of the extract. The extracts showed only moderate antimicrobial activity compared to that of control antibiotic used (Table 1).

DISCUSSION

The present study evaluated the antimicrobial efficacy of aqueous extract of *Ulva lactuca* against common oral pathogens. Seaweeds contain various bioactive compounds that are beneficial for human health. *Ulva lactuca* is of the family Chlorophyta (green algae), which has plethora of secondary active metabolites. Also, the presence of phytochemicals such as terpenoids, flavonoids, saponins, and alkaloids are documented to be responsible for antibacterial activities and antioxidant activities.^{11,12}

The present study showed that *Ulva lactuca* extract showed only moderate activity against the oral pathogens when compared to the control antibiotic. The results are similar to the study conducted by Kolanjinathan et al.,¹³ where they tested the antimicrobial efficacy of *Ulva lactuca* against many human pathogens. The mean zone of inhibition (ZOI) against *S. aureus* was in the range of 7–10 mm of all the extracts, i.e., methanol, acetone, ethyl acetate, etc. They concluded that the

Table 1: Mean zone of inhibition of *Ulva lactuca* against oral pathogens

Name of the pathogen	Zone of inhibition (concentration)			
	25 µL	50 µL	100 µL	Ab
<i>S. aureus</i>	8	8	8	12
<i>S. mutans</i>	8	8	8	18
<i>E. faecalis</i>	8	8	8	12
<i>Lactobacillus</i>	8	8	8	40

Ulva lactuca extracts were having moderate efficacy. Our present study findings are further supported by another study by Alang et al.,¹⁴ where they assessed the antimicrobial activity of *Ulva lactuca*. In their study, the mean ZOI of aqueous extracts was 8 mm against *S. aureus*.

Another study by Sujatha et al.¹⁰ studied the antibacterial of green seaweeds on oral pathogens. *Ulva fasciata* which is similar to the species *Ulva lactuca* showed only moderate activity against oral bacteria, namely, *S. mutans* (mean ZOI 2.8 mm), *S. mitis* (mean ZOI 3.83 mm) and *A. viscosus* (mean ZOI 4.3 mm) compared standard antibiotic in the range of 10–11 mm. Thus, our study findings are consistent with previous researches. Although *Ulva lactuca* showed moderate antimicrobial activity against the common oral pathogens, given its natural and inexhaustible source without any harmful side effects makes it an ideal candidate for use as oral hygiene agents like mouth rinse, varnish, or toothpaste. This study had few limitations: minimal inhibitory concentration was not done using broth dilution method, and the microorganisms used from stock cultures. Thus, this study can be considered only as preliminary research further research is required to explore the possibility of use as oral hygiene agents.

CONCLUSION

The present study showed that aqueous extracts of *Ulva lactuca* had only moderate antimicrobial activity compared to the commercial antibiotics. It could be hypothesized that the algal extract as a whole may have only moderate efficacy; however its metabolites or components like sulfated polysaccharide could possess better antimicrobial efficacy.

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