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Investigation and Antibacterial Activity of Libyan Macroalgae *Ulva fasciata*

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ABSTRACT

Marine macroalgae are considered as an excellent source of bioactive compounds which has a broad range of biological activities including antibacterial and antioxidant. The qualitative phytochemical screening of the methanol extract and ethyl acetate extract of *Ulva fasciata* revealed the presence of Carbohydrates, Steroids, Flavonoids, gums and mucilage, Tannin & Phenols, Saponins, Proteins, and glycosides in both extract .Antibacterial activities of the methanol extract and ethyl acetate extract of *Ulva fasciata* from Benghazi coast was evaluated against both Gram positive and Gram negative human pathogens bacteria by agar well diffusion method. The results indicated that this species of seaweed collected from the coast of Benghazi present a significant capacity of antibacterial.

Introduction

Marine organisms are source material for structurally unique natural products with pharmacological and biological activities **[1].** Among the marine living beings, the macroalgae involve a vital put as a source of biomedical compounds **[2].** Approximately 2400 common items have been confined from macroalgae having a place to the classes Rhodophyceae, Phaeophyceae and Chlorophyceae **[1].** The antimicrobial movement was respected as an pointer to identify the strong pharmace-utical capacity of macroalgae for its blend of bioactive auxiliary metabolites **[3].** The compounds derived from macroalgae are reported to have broad range of biological activities such as antibacterial **[4]** anticoagulant **[5]** and antifouling activity **[6].** Recently, infections have become the leading cause of death world-wide which has led to an increase in antibacterial resistance, making it a global growing problem **[7].** More and more bacteria are developing resistance to antibiotics conferred by randomly mutated genes **[8].** Each year infectious diseases cause 14 million deaths worldwide, with mortality increasing even in the United States at an annual rate of 4.8 percent. In 2000, the World Health Organization (WHO) estimated that pneumonia, diarrhoeal disease, and tuberculosis accounted for more than half the deaths due to infectious disease worldwide. The problem is worsened by antibiotic resistance, as well as the emergence of new pathogens with the potential for rapid global spread **[9].** In addition to this problem, antibiotics are sometimes associated with adverse effects on the host including hypersensitivity, immune suppression and allergic reactions **[10].** Now, Scientists accepted that antibiotics will leave healthcare professionals without effective therapies for bacterial infections for example Staphylococcus aureus. It is estimated that about half of all strains found in many medical institutions are resistant to antibiotics such as methicillin **[11];** or enterococci, which are resistant to widely effective antibiotic, Vancomycin **[12].** In this way, there's an insistent got to find unused antimicrobial compounds with assorted chemical structures and novel mechanism of activity for modern and re-emerging irresistible infections. The new therapeutic agents should be effective and have a novel mode of action that renders them impervious to existing resistance mechanisms.

Not only drugs from natural sources have new structural features, with novel biological activity but phytochemicals derived from them are also extremely useful as lead structures for synthetic modification and optimization of bioactivity. The discovery and improvement of anti-microbial are among the foremost capable and effective accomplishments of present day science and innovation for the control of irresistible maladies. Drawn out utilization of wide range antibiotics have driven to the emergence of drug resistance. There is a colossal require for novel antimicrobial agents from diverse sources **[13].** The biodiversity of marine environment gives an imperative source of chemical compounds which have numerous helpful applications. More and more chemist and biologist pay attention to the constituents of the algae; if their natural products are explored, they may lead to an efficient lead for the discovery of new drug molecules against several pathogens causing infectious diseases **[14].**

The green macroalgal genera Ulva is widely distributed from marine to fresh water all over the world. The cosmopolitan genus Ulva Linnaeus, commonly known as the "sea lettuce", is represented by species distributed in all oceans and estuaries of the world **[15].** Ulva species is rich in cell-wall polysaccharides, including cellulose and water-soluble polysaccharides that contain sulphate groups **[16].** Sulphated polysaccharides from marine algae are known to exhibit many biological and physiological activities including antimicrobial **[17-18],** anticoagulant **[19],** anti-hyperlipidemic **[20],** antiviral **[21],** and antitumor **[22]** and antioxidant activities **[23].**

Ulva fasciata is edible and is often called 'Sea Lettuce'. Species with hollow, one-layered thalli were formerly included in Enteromorpha, but it is widely accepted now that such species should be included in Ulva .

Material and method

Algae collection and Identification

Macroalgae Ulva fasciata was collected by hand picking (within the latitude 32° 8'27.79" N and longitude 20° 4'37.73" E) form Benghazi coast in 15 April 2018, the algae were cleaned and washed thoroughly in sterile sea water. Samples were manually cleansed of sand, epiphytes and animal, and then rinsed in distilled water to remove salt. Then dried for 48 hr in natural light in 25ºC, the dry seaweeds were crushed in an electrical mill until a fine powder was obtained, and stored in bottles at room temp. The algae were identified by Former Prof. M. Eghdih Department of Botany, Benghazi University.

Preparation of algal extract

Ten grams of seaweed powder were extracted in 100ml organic solvent (Methanol/ Ethyl-acetate) through exhaustive cold maceration for 24 hours. The extract was filtered through a Buckner's funnel using Whatman filter paper. The solvent were evaporated under vacuum in rotary evaporator at 40 °C and the dried extracts were stored at 4 °C for further chemical examination and/ antibacterial assay.

Phytochemical analysis

Algal extracts were subjected to qualitative tests for the identification of various phytochemical constituents such as phenols, flavonoids, tannins, alkaloids, coumarine, saponins, quinine, carbohydrate, terpenoids, glycosides, phlobatanins, steroids and proteins following standard procedures **[24].**

Antimicrobial study

The Two extracts were screened for their antibacterial activities against Gram positive bacteria (*Staphylococcus aureus*, *Streptococcus spp*); Gram negative bacteria (*Escherichia coli*, *Pseudomonas aeruginosa*, *Klebsiella pnemoniae and Proteus spp*.) by agar well diffusion method **[25]**. Solvent used as negative control. Zones of growth inhibition were evaluated after 18 hours of incubation at 37°C. All experiments were done in triplicate.

Results and Discussion

Phytochemical screening

The qualitative phytochemical screening of the methanol extract and ethyl acetate extract of Ulva fasciata was carried out in order to assess the presence of bioactive compounds which might have antibacterial potency. The presence of Carbohydrates, Steroids, Flavonoids, gums and mucilage, Tannin & Phenols, Saponins, Proteins, and glycosides was investigated in both extract. These results are consistent with the previous studies from different areas **[26].** Alkaloids were absent in both extracts. The presence of Phenols and flavonoids in the algae is interesting because of their possible use as natural antioxidants and antimicrobials. Many reports revealed the presence of flavonoids in marine algae and some of them have been investigated for their biological activity. The antifungal, antiviral and antibacterial activities of saponins are well documented **[27].**

The antibacterial activities of algal extracts :

Antibacterial activities of the methanol extract and ethyl acetate extract of Ulva fasciata from Benghazi coast was evaluated against both Gram positive and Gram negative human pathogens bacteria by agar well diffusion method and the results are shown in Table 1.

Table (1) the antibacterial activities of Ulva fasicata Extracts

Target microorganisms	Methanolic Extract	Ethyl acetate Extract
Escherichia coli	++	++
Klebsiella pnemoniae	++	++
Proteus sp	--	++
Pseudomonas aeruginosa	++	++
Streptococcus sp	++	++
Staphylococcus aureus	++	++

The Table 1 show the effects of Ulva fasicata on 6 bacterial strains using two different solvents. The Ethyl acetate extracts of Ulva fasciatas showed strong inhibitory effects against all the microorganisms tested. Our results were similar to the results of Tuney *et al*., (2006) **[28].** It is evident from the clear zone of inhibition obtained in the present study against all the organisms tested, that the ethyl acetate extract of Ulva fasciata are bactericidal in nature. In conclusion, Ethyl acetate extracts of selected seaweeds were potentially a good source of antibacterial substances with a broad spectrum of activities in preventing the growth of all the microorganisms tested.

Conclusion

Seaweeds are incredible creation of secondary metabolites, which are not found in earthly condition. In this manner marine algae is the most extravagant wellspring of know novel bioactive compounds. Seaweeds gathered from Benghazi (Libyan) activities. These perceptions indicated their significance as a potential hotspot for natural dynamic compounds, for example, antibacterial substances. This examination recommends the probability of utilizing seaweed extracts as natural antimicrobials in the food industry. Further research considers are being done on different types of species from a similar environment so as to give total information of the antimicrobial potential Seaweeds along the cost of Libya. It is also necessary for successful separation, purification and characterization of biologically active compounds using chromatographic and spectroscopic techniques for the synthesis novel antibiotics. Moreover, toxicological studies are needed to be performed. At long last we reason that macroalgae from the Libyan coast are potential wellsprings of bioactive compounds and should be examined for normal anti-infection agents. This investigation has demonstrated that the creation of antibacterial substances by macroalgae is an ordinary event among those found on the shoreline of Libya. Biochemical examination are right now attempted to determine the structure and nature of these compounds.

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