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STUDYING ABOUT PHARMACOLOGICALPROPERTIES & EFFECT OF SEAWEED-ASSOCIATED BACTERIA

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ABSTRACT

Seaweeds (macroalgae) rely heavily on the bacteria found in and on seaweeds for their morphogenesis and development. Proteobacteria and Firmicutes are the most frequent bacterial phyla on seaweed. Accompanying bacterial populations contribute to typical seaweed shape, development, and growth by producing plant growth-promoting chemicals, quorum sensing signaling molecules, bioactive compounds, and other advantageous substances. The bioactive compounds produced by related bacteria not only protect the host from dangers in the pelagic environment, but also define which bacterial species are found on a certain seaweed. Ecological functions of cross-domain communication between seaweeds and bacteria include the release of carpospores in red seaweeds and the settling of zoospores in green seaweeds. This review adds to the growing body of evidence that highlights the role of extracellular polymeric molecules in seaweed spore formation and germination. Understanding the molecular mechanisms underlying reported ecological occurrences in seaweeds requires a combination of ecological, microbiological, and biochemical techniques.

Keywords: -Seaweed, Bacteria, TFC, SAMCs, Plasma

I. INTRODUCTION

The seaweed's surface is a highly dynamic contact between the host and the external environment. Nutrients, waste materials, and secondary metabolites are all taken in and excreted through this interface. Seaweed surfaces are ideal for the colonization of a wide variety of microorganisms, and they also produce organic compounds that encourage bacterial growth and biofilm development. Environmental factors, such as the presence or absence of inorganic fertilizers and organic matter, have a significant impact on the symbiotic relationships between seaweeds and bacteria. To survive quick and severe environmental changes, the holobiont (host plus its symbionts) may rely on the assistance of the numerous bacterial communities with which it is linked. Stress tolerance and the bioremediation of pollutants like hydrocarbons and fertilizers may be attributable, at least in part, to bacterial strains found in association with seaweeds.

Seaweed associated microbial communities (SAMCs) play a crucial role in the health of their hosts, but little is known about how and why SAMCs differ across wide geographic areas. Next-generation sequencing (NGS) has recently emerged as a potent method for examining bacterial communities associated with marine eukaryotes, and its application to the characterization of SAMCs allows a thorough evaluation of bacterial community structure and diversity. As a result, several studies in the last few years have investigated SAMCs' temporal and spatial dynamics.

II. PHARMACOLOGICAL PROPERTIES OF SEAWEEDS

In addition to providing essential nutrients, seaweeds have also been traditionally utilized to cure a variety of medical conditions (Fig. 1), including microbial infection, cancer, tumor, allergy, aging, and inflammation. Human studies on colon and breast cancer found that some types of seaweed have anticancer effects, as demonstrated by Ghislain17, et al. Several types of seaweed have been shown to have a cancer-preventative effect by inhibiting or preventing the growth of cancer cells. Seaweeds' high antioxidant activity is a key factor in slowing the growth of cancer cells. It has also been suggested that seaweed may provide some protection against cardiovascular disease. Dietary intake of seaweeds reduces the level of plasma cholesterol and thus, reduces the risk of cardiovascular diseases.

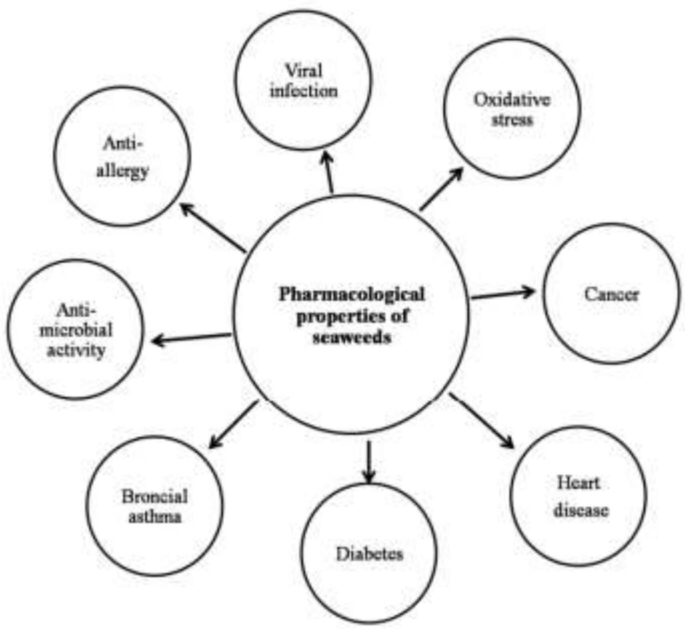

Figure 1. Some important pharmacological properties of seaweeds.

Antioxidants in seaweed have been proven to slow the aging process. Antioxigenic activity, inhibition of cell adhesion, binding toxic compounds, induction of apoptosis, and the addition of important trace minerals are just some of the bio-chemical changes stimulated in humans by seaweed consumption, which are largely responsible for preventing chronic diseases and slowing the aging process36. Diabetics may also benefit from eating seaweed. In an in-vivo investigation, blood glucose and glycosylated hemoglobin levels were dramatically lowered after oral administration of an aqueous extract of Ulvafaciata compared to other common treatments. The antibacterial activity of methanolic seaweed extract is greatest against Staphylococcus, Bacillus, Streptococcus, Enterobacter, Escherichia coli, and Proteus. Carrageenans, fucoidans, and rhamnogalactans are only few of the seaweed sufated polysaccharides that have been shown to be beneficial against viral infection. These chemicals found in seaweed are both virucidal and enzyme inhibitors, meaning they prevent viruses from entering cells. In contrast, an in-vivo study showed that methanolic extracts of the seaweeds UndariaPinnatifida and Ulvalinza have anti-inflammatory properties. Dictyotadichotomamethyloic extract was discovered to have a substantial impact on -lactamases by inhibiting GES-22, which may aid in preventing the establishment of antibiotic resistance in bacteria in people.

The red algae Aghardhiellatenera and Nothogeniafastigiate, both of which contain sulphated polysaccharides, are well-known for their antiviral activity. Sulphated polysaccharide from Schizymeniapacifica was shown to block HIV reverse transcriptase in an in vitro investigation, as reported by Nakashima et al. Fucoidans and other polysaccharides isolated from Adenocystisutricularis brown seaweed have been shown to have antiviral action against drug-resistant HIV-1 wild type, as reported by Trinchero41 et al. In vitro studies have shown that the seaweed carrageenan can inhibit the growth of HIV and other STD-causing viruses. In addition to their cleaning properties, several of the substances found in seaweeds, such as aldehyde, ketone, hydroquinone, alkenes haloforms, alkanes, sterols, terpenes, natural pigments, polyphenols, and alcohols, also have antibiotic, antioxidant, antimalarial, cytotoxic, and antiseptic effects. Human Pseudomonas aeruginosa infections are a target for the antibacterial action of a halogenated chemical furanone found in Deliseapulchara seaweed.

Seaweed phenolic extract is effective in treating bronchial asthma and may be utilized as an antioxidant in a wide variety of foods and medicines. Brown algae (Eclonia cava, Costariacostalla, Sargassumhorney, Undariapinnnatifida) contain fucoidans that may be employed as effective anti-tumor agents14,39 because they slow the growth of human melanoma and colon cancer cells. Seaweed's many components have powerful antioxidant activity, which is responsible for relieving cellular oxidative stress and curing a number of debilitating illnesses. Cancer, cardiovascular disease, HIV/AIDS prophylaxis, and malaria are all thought to be impacted by the physiologically active metabolites found in seaweed, although the precise mechanism of action is unclear. In addition, seaweeds have qualities that make them effective as an anthelmintic, a hepatoprotective, and a wound healer.

III. EFFECT OF PROCESSING ON SEAWEEDS

Like with vegetables, the type of processing and processing conditions affect the bioactive compounds of seaweeds. Researchers Rajauria33 et al. showed that hydrothermal processing greatly reduced the levels of beneficial chemicals and antioxidant activity in three types of edible Irish brown seaweed: Laminariasaccharina, Laminariadigitata, and Himanthaliaelongata. After autoclaving various seaweeds at temperatures ranging from 85 °C to 121 °C for 15 minutes, they found that the total phenolic content was reduced by 1.6–1.9 fold, the total flavonoid content was reduced by 1.6–3.3 fold, the total surface tannin content was reduced by 1.3–2.6 fold, and the total sugar content was reduced by 1.9–4.3 fold. Researchers discovered that hydrothermal processing significantly reduced the antioxidant activity, metal chelation capability, and peroxide scavenging capacity of seaweeds. Total phenolic content (TPC), total flavonoid content (TFC), total surface tannin content (TTC), and antioxidant activity (AOA) of H. elongata seaweed were all reported to change after being subjected to various processing methods in a separate study by Cox9 et al. They discovered that whereas the TPC concentration was lowered after boiling, it was actually raised following microwave processing. The most TFC was lost from seaweed after microwave cooking, while a minor gain was seen after pre-drying and boiling. The most TTC was lost during the boiling process, whereas just a fraction was lost while drying. However, the combined processing of predrying and boiling led to the greatest losses of AOA in the seaweed.

IV. THE MULTIFACETED ROLES OF SEAWEED-ASSOCIATED BACTERIA: FRIENDS OR FOES?

Bacteria Supply Key Nutrients and Are Required for Normal Morphological Development of Seaweeds

Epiphytic heterotrophic bacteria provide essential nutrients for macroalgalphotoautotrophy, development, and survival, including carbon dioxide (CO2) and fixed nitrate (NO3).

Since autotrophic cyanobacteria are commonly found on benthic macroalgal species, it is possible that epiphytic bacteria contribute to or supplement the primary production of the macroalgal host.

Furthermore, several species of macroalgae benefit from the presence of epiphytic bacteria, which influences their morphological development. Indeed, without their natural bacterial communities, some green microalgae do not form their typical morphology. Sea lettuce, or Ulvaaustralis (Areschoug), is a green seaweed that, when grown axenically, takes on an abnormal 'pincushion'-like morphology that can be reversed by reinoculation with bacterial strains isolated from the alga [38, 39]. Also known as Enteromorphalinza, Ulvacompressa (Linnaeus), Ulvafasciata (S.F.Gray), and Gayraliaoxysperma (Kützing) K.L. Vinogradova ex Scagel and al., formerly known as Monostromaoxyspermum (Kützing), have been linked to similar health benefits.

Microorganism-Mediated Biofouling: Ecological Significance for Seaweeds and Their Antibiofouling

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V. CONCLUSION

When it comes to nutrients and bioactive chemicals, seaweeds provide almost everything the human body needs. Some synthetic chemicals used to treat chronic diseases in living things could be replaced by seaweeds. Since the nutritional and functional components of seaweed vary with species, genus, time of year, and geographical location, an evaluation is necessary prior to their use. Seaweeds are valuable to the food and beverage sectors due to their high biochemical activity and antioxidant characteristics, but they are also significant to the nutraceutical and pharmaceutical businesses. The natural chemicals found in seaweeds have been utilized to treat cancer, tumors, aging, inflammation, and cardiovascular disease. Some types of seaweed may cause allergic reactions in humans, so it's important to be careful when choosing edible seaweed to eat.

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