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Marine Glycoconjugates: Natural Products from Marine Fungi

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Abstract

Glycoconjugates are utilised in medicine, such as vaccinations, and have important functions in biological systems. Cellular contacts, such as cell-cell recognition and the binding of cells to the intercellular matrix, are mediated by glycoproteins, peptidoglycans, lipopolysaccharides, and other biopolymer glycoconjugates. These molecules carry out signalling, antigenic, and transport duties and take role in the synthesis of receptors and other crucial blood and membrane components. They are essential for preserving the physical condition of connective tissue due to the negative charges on some sulfated glycoconjugates and the binding of water. Low molecular weight glycoconjugates, including glycolipids and triterpene and steroidal glycosides, are also widely known as compounds with significant internal and external functions. A wide range of biological actions, including protective, cytotoxic, anticancer, immunomodulatory, and antioxidant capabilities, are displayed by various glycoconjugates. For signal or anti-predatory exometabolites of marine species to be highly soluble in water, carbohydrate moieties must have this ability. The extremely large variety of glycoconjugates of marine origin, including those given in the current Special Issue, is explained by all these features.

Keywords: Glycoconjugates; Glycosides; Carbohydrate; Marine

Introduction

In the review study, Stonik and Stonik reviewed sterol and sphingolipid glycoconjugates, which are common but inadequately researched metabolites of microalgae. In microalgae, glycosylated sterols perform crucial biological roles and exhibit a variety of advantageous traits that can be used in food and medicine. Through food chains, dietary sterols and their glycoconjugates from microalgae reach marine invertebrates, where they may be transformed into 7(8)-unsaturated sterols and their derivatives, including polyhydroxylated sterols and, most likely, the glycosides of starfish and sea cucumbers. Despite extensive research, the knowledge of microalgal glycosphingolipids is still limited. Some of them have significant effects on pathogen interactions and have the potential to cause microalgae to undergo apoptosis. They assist in putting an end to microalgal blooms as well [1].

"Antitumor Potential of Marine and Freshwater Lectins" discusses the function of marine and freshwater lectins, substances that uniquely recognise carbohydrate ligands, as anticancer medicines. The researchers came to the conclusion that lectins from aquatic organisms have significant promise for the future of anticancer research since they exhibit a wide range of inhibitory actions against tumour cells and cause apoptosis and other types of cell death. Some of these lectins have the ability to improve the antineoplastic effects of popular anticancer drugs. The capacity of the lectins to recognise the glycosylated patterns of distinct cell types allows them to discriminate between normal and altered cells as well as different types of tumour cells in the majority of cases. Animal tests using lectins showed that they had the best anticancer effects with the least amount of harm [2, 3].

Deep-sea mushrooms are found in severe sea conditions that are thousands of metres below the surface, where they are often distinguished by the absence of sunlight irradiation, primarily low temperature, high hydrostatic pressure, and oligotrophy. Numerous fungi have been isolated from numerous deep-sea settings ever since the first report of fungal isolation from the ocean. Due to the chemical diversity and biodiversity of their secondary metabolites, which have the potential to be exploited for drug development and therapeutic applications, fungi isolated from deep-sea samples are one of the most important and promising sources for bioactive chemicals [4-6].

Five new benzophenone derivatives, sharing rare naturally occurring aldehyde functionality in this family, and a new eremophilane derivative, along with two known compounds, from the deep-sea fungus *Phomopsis lithocarpus* that was isolated from a deep-sea sediment sample obtained in the Indian Ocean at the depth of 3606 m. With IC50 values of 16.0 and 17.6 M, respectively, one of the novel compounds, tenellone H, demonstrated cytotoxic action against the HepG-2 and A549 cell lines. The maritime environment is home to a wide variety of symbiotic partnerships, and many marine animals, including invertebrates and other marine macro-organisms, coexist harmoniously with their microbial communities. A remarkable source of extremely diverse microbial communities, including novel fungus species are marine sponges, often known as microbial fermenters. Among marine sources, sponge-derived fungi are one of the largest sources of several secondary metabolites with distinctive structural characteristics and biological activity, identified 21 known compounds and seven novel structurally varied polyketide derivatives from cultures of the sponge-derived fungus *Alternaria sp*. With IC50 values of 26.58 0.80, 8.75 0.13, and 13.11 0.95 g/mL, respectively, against human erythroleukemia (K562), gastric cancer cells (SGC-7901), and hepatocellular carcinoma cells (BEL-7402), Altertoxin VII shown cytotoxic effects [7].

As opposed to other compounds where the phenolic hydroxy groups have often been substituted at C-4 and C-9, this one is the first example of a new 4, 8-dihydroxy-substituted perylenequinone derivative. In the study, *Aspergillus sp*., which was discovered in the

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gut of a marine isopod called *Ligia oceanica*, was cultured in a variety of broths. By using the OSMAC approach and altering the culture conditions, two novel aspochalasins, tricochalasin A and aspochalasin A2, as well as three known compounds, were isolated from the broths. Eight new meroterpenoids and isocoumarinoids, which are fungal natural products, were discovered in the culture of the salt-tolerant plant-associated fungus *Myrothecium sp*. This study demonstrated the significance of fungus as biological sources for novel and beneficial natural compounds in salt-tolerant plants [8].

Discussion

Even though it is believed that there are more than 10,000 marine fungal species, studies of marine fungi have largely been neglected since Durieu and Montagne discovered the species *Sphaeria posidoniae (Halotthia posidoniae)* on the rhizome of the sea grass *Posidonia oceanica* in 1846. Although estimates for the number of fungal species on the globe range from 1.5 to over five million, it is estimated that less than 10% of fungi have been identified to date. As of this writing, only about 1100 species have been solely retrieved from the maritime environment. Fungi have been discovered in almost all of the marine habitats that have been studied, from the deep sea to the surface seas, including sediments, the water column, driftwood, sessile and mobile invertebrates, algae, and marine mammals. The research of marine fungi found in unique and challenging environments is thought to advance the isolation of novel marine fungi, which may then result in the isolation of novel secondary metabolites [9].

Conclusion

This Special Issue's description of the variety of marine glycoconjugate sources and their chemical structures is remarkable. Two articles discuss, respectively, a sea cucumber's glycoprotein and fascinating biologically active microalgal metabolites such steroid and sphingoid glycoconjugates. In one publication, the fatty acid composition and thermotropic behaviour of *Ulva lactuca*, a green macrophyte, are discussed. Lectin topics are covered in three articles. Another study discusses the use of a sponge lectin in the creation of a recombinant virus, while a review piece examines the outcomes and future prospects of the use of marine and freshwater lectins in experimental oncology and the treatment of oncological disorders. Triterpene glycosides from sea cucumbers are the subject of two articles, while steroid glycosides from starfish are covered in two more. *Apostichopus japonicus* sea cucumber glycosaminoglycan has been shown in one study to reduce hyperglycemia in the liver of mice with insulin resistance [10].

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Conflict of Interest

None

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