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Marine products: An alternative medicine for the treatment of ocular disease

S.Bharathi*

Department of Optometry, Dhanalakshmi Srinivasan University, Perambalur-621 212
Corresponding Author: S.Bharathi
E-mail: revabharathi35@gmail.com and Phone no: 9600598616
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ABSTRACT

Introduction:

The recent years have seen an increase in ocular illnesses. If it is left untreated, it escalated to a very serious condition. Emerging research encompassing more than a decade investigates the role of marine drugs in ocular diseases. Conventional treatment is not a permanent cure for all ocular diseases, nor is it always beneficial in certain situations.

Aim:

The review objective is to highlight the several marine drugs sources and their importance in treating disorders of the eye.

Methodology:

Marine based drugs played a vital role in various eye disorders. There are some marketed formulations derived from marine sources exhibit greater therapeutic effects than currently available pharmaceuticals. Isolated constituents from marine sources such as astaxanthin, fucoidan and quinoid pigment play a vital role in treating ocular disease. The various studies suggested the potential of the active constituents.

Conclusion:

These marine based pharmaceuticals have been successful therapeutic agents as well as alternative for the conventional dosage form long term therapy.

Keywords: Marine drugs, eye disorders, pharmaceuticals, conventional dosage and therapeutic effects.

INTRODUCTION :

According to a recent survey, 2.75 billion people worldwide suffer from low vision for a variety of causes, including dry eyes, computer vision syndrome, age-related eye illness, and eye strain. A recent research reveals that vision impairment is linked to a lower quality of life, which is measured by social, emotional, and physical well-being.
Lower quality of life related to vision, everyday visual function, and the capacities to carry out visual tasks are all associated with visual impairment. [1]

These marine natural product-producing species fall into three main biological groupings. Marine algae, marine invertebrates, and marine microorganisms—including phytoplankton—are among them. According to their chemical makeup, the marine natural products are categorized into seven classes: peptides, ethers (including ketals), phenols (including quinones), steroidal saponins, alkaloids, terpenoids, and phenols.[2]

Since it is hard to find and produce large amounts of novel drug leads from marine sources, developing medicinal products from these sources is a very time-consuming procedure.[3] The primary obstacle to the manufacturing of novel pharmaceuticals from the sea in the future remains the inadequate supply; nonetheless, two viable solutions—fermentation and aquaculture—are offered.[4]

Astaxanthin is a red carotenoid pigment that occurs naturally and belongs to the xanthophyll family. It is mostly found in marine habitats, particularly in microalgae and shellfish like lobster, shrimp, and salmonids. Numerous research on humans and animals have documented the effectiveness of this

carotenoid in the treatment of asthenopia, cataracts, uveitis, ocular surface abnormalities, and retinal illnesses.[5] Astaxanthin demonstrates robust antioxidant properties, with values between 10 and 100 times greater than those of β-carotene and α-tocopherol.[6]

METHODOLOGY :

A single-group, prospective quasi-experimental study comprising 60 middle-aged and elderly individuals with mild-to-moderate dry eye disease (DED) was conducted on 120 eyes. For 30 days, six mg pills of astaxanthin were taken orally, twice a day. Prior to the test, information about systemic illnesses, eye conditions, treatments, and medications was documented. The ocular surface disease index (OSDI) questionnaire, the non-invasive tear break-up time (NIBUT), the fluorescein break-up time (FBUT), the corneal fluorescein staining (CFS) score, the eyelid margin signs, the meibomian gland (MG) expressibility, the meibum quality, the meibomian gland dropout (MGDR), the Schirmer I test (SIt), the tear meniscus height (TMH), the degree of bulbar conjunctiva congestion, the frequency of blinks, the incomplete blink rate, and the thickness of the tear film lipid layer were also collected prior to, during, and following treatment. Monitoring of the anterior segment, fundus, visual acuity (VA), intraocular pressure (IOP), discomfort feelings, and other adverse reactions were also done during the trial to evaluate safety. Oral astaxanthin therapy ameliorates middle-aged and older patients' mild-to-moderate DED symptoms and indicators.[7]

Employing a normal-tension glaucoma (NTG) animal model, which lacks the glutamate/aspartate transporter (Glast) and exhibits spontaneous RGC and optic nerve degeneration without increased intraocular pressure, the cytoprotective effect of astaxanthin (AST) on retinal ganglion cell (RGC) degeneration is investigated. Intraperitoneal injections of AST at 10, 30, or 60 mg/kg/day or vehicle alone were given to three-week-old Glast± mice, whereas littermate control mice received vehicle alone for 14 days. When AST was administered at a dose of 60 mg/kg per day, as opposed to using a vehicle alone, RGC loss was reduced.[8]

Fucoidan

One of the main causes of dry eye disease is hyperosmotic stress brought on by tear hyposection. We used Sargassum horneri extract (AB_SH) and its bioactive component fucoidan to explore the prevention of dry eye disease in corneal epithelial cells and in rats that were induced to develop dry eye disease by unilateral excision of their exorbital lacrimal gland. For seven days, AB_SH (250 mg/kg and 500 mg/kg) and fucoidan (100 mg/kg) were administered orally. Together with corneal irregularity assessments, phenol red thread tear tests were used to gauge tear production. Using TUNEL staining, the apoptotic damage in the lacrimal gland and cornea was assessed. It has been demonstrated that in human corneal epithelial cells, AB_SH and fucoidan inhibit apoptosis and the production of apoptosis-related proteins under hyperosmotic conditions.

In rats with excised lacrimal glands, oral treatment of AB_SH and fucoidan reduced tear hyposecretion and corneal irregularity. Fucoidan and AB_SH also decreased apoptosis in the lacrimal gland and cornea. According to this study, fucoidan and S. horneri extract can successfully treat dry eye disease by preventing ocular tissue death. [9]

The inflammatory pathological alterations in the retina are influenced by hypertension. The inflammasomes have an important role. To determine whether NOD-like receptor thermal protein domain associated protein 3 (NLRP3) inflammasome activation and the possible protective effects of fucoidan (FO) in mouse retinal vascular endothelial cells (mRECs) and mice retina regulate angiotensin II (Ang II)-induced hypertensive retinopathy and inflammation.

The NLRP3 inflammasome pathway is negatively regulated by SIRT1, which exacerbates Ang II-induced inflammation and hypertensive retinopathy. FO may reduce Ang II-induced retinopathy and dysfunction via adjusting SIRT1/NLRP3 expression. [10]

Quinoid pigments

Sea urchins Scaphechinus mirabilis (family Scutellidae) and Strongylocentrotus intermedius (strongylocentrotidae) have quinoid pigments. Sea urchin naphthoquinoid pigments offer a promising avenue for the synthesis of pharmaceuticals with a range of pharmacological properties. Echinochrome A is used to treat and prevent lipid and carbohydrate metabolic problems associated with aging, as well as cardiovascular illnesses.[11]

Histochrome, a marine medication, is a unique type of natural antioxidant. Echinochrome A, also known as 7-ethyl-2,3,5,6,8-pentahydroxy-1,4-naphthoquinone, is the most prevalent quinonoid pigment found in sea urchins and is the drug's active ingredient. Because of Ech A's special ability to concurrently block many links in the chain of free radical processes, the medication is employed in cardiology and ophthalmology. [12]

CONCLUSION :

Owing to the review, marine materials with high therapeutic impact in animal models include fucoidan, astaxanthin, and quinoid pigments. Research on insilico molecular docking will be carried out to determine the compound's binding effectiveness in the relevant receptor. The link between structural activity and the mechanism behind isolated marine constituents has to be found. Nonetheless, extensive clinical trials must be conducted to determine the products safety and efficacy. When taking into account the severity of a condition and various alternative therapies, the repercussions of providing these medications are far less severe.

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