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Marine Derived: A Promising Source of Nutraceuticals

S.R. Lende[1], R.A. Khileri[2], S.I. Yusufzai[3], S.S. Rathore[4] and P.J. Mahida[5]

[1,2,3,4,5]College of Fisheries, Junagadh Agricultural University, Veraval (Gujarat)
E-mail: [1]lendesmit@gmail.com, [2]rckhileri@gmail.com, [3]saj811@yahoo.com,
[4]09nasa10@gmail.com, [5]parvez_aalam89@ymail.com

Abstract—*Maintaining a healthy lifestyle is a basic need for most people. A nutraceutical are the substance that may be considered a food or a part of a food and provides medical or health benefits including the prevention and treatment of disease The present article is emphasis on the potential derivatives of marine sources which are promising source of nutraceuticles.*

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Keywords: *Global warming, coral reef, climate change*

1. INTRODUCTION

Maintaining a healthy lifestyle is a basic need for most people. It is well known that good health is strongly associated with diet and many other factors such as genetics, environment, lifestyle habits, and physical activity. People are highly concerned about selecting healthy foods with a wide range of medicinal values to reduce their risk of chronic diseases such as coronary heart diseases, hypertension, obesity, cancer, diabetes, and osteoporosis. Numerous reports have shown that marine-based food products have remarkably higher benefits in maintaining good health and well-being (Jha and Zi-rong, 2004; Rajasekaran *et al*., 2008).

Drugs and food from natural origin play an important role in public healthcare system throughout the world. The word nutraceutical is a broad term describing foods, food ingredients, and dietary supplements that provide specific health or medical benefits, in addition to the basic nutritional value found in the food (Jain N. and Ramawat K.). Foods that promote health beyond

Providing basic nutrition are termed "functional foods." These foods have the potential to promote health in ways not anticipated by traditional nutrition science. The term "nutraceutical" was coined in 1989 by the Foundation for Innovation in Medicine (New York) to provide a name for this rapidly growing area of biomedical research. A nutraceutical was defined as any substance that may be considered a food or a part of a food and provides medical or health benefits including the prevention and treatment of disease (Andlauer and Furst, 2002). Nutraceuticals possess pertinent physiological functions and valuable biological activities. Interestingly, during the last 2000 years, from the time of Hippocrates (460–377 BC) to the dawn of modern medicine, little distinction was made between food and drugs.

The concept of nutraceuticals is not entirely new, although it has evolved considerably over the years. In the early 1900s, food manufacturers in the United States began adding iodine to salt in an effort to prevent goiter (an enlargement of the thyroid gland), representing one of the first attempts at creating a functional component through fortification. Today, researchers have identified hundreds of compounds with functional qualities, and they continue to make new discoveries surrounding the complex benefits of phytochemicals (nonnutritive plant chemicals that have protective or disease-preventive properties) in foods.

There is a slight difference between the functional foods and nutraceuticals. When food is being cooked or prepared using "scientific intelligence" with or without knowledge of how or why it is being used, the food is called "functional food." Thus, functional food provides the body with the required amount of vitamins, fats, proteins, carbohydrates, etc., needed for its healthy survival. When functional food aids in the prevention and/or treatment of disease(s) and/or disorder(s) other than anemia, it is called a nutraceutical (Since most of the functional foods act in some way or the other as antianemic, the exception to anemia is considered so as to have a clear distinction between the two terms, functional food and nutraceutical).

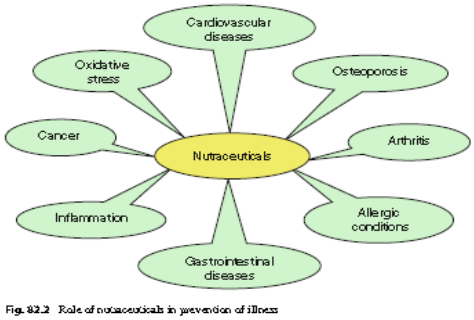

Fig. 1: Causes of deaths in India

Examples of nutraceuticals include fortified dairy products (e.g., milk) and citrus fruits (e.g., orange juice).

2. CLASSIFICATION OF NUTRACEUTICALS

Nutraceuticals are nonspecific biological therapies used to promote wellness, prevent malignant processes, and control symptoms. It is a broad umbrella term used to describe any product derived from food sources that provides extra health benefits in addition to the basic nutritional value found in foods. Phytochemicals and antioxidants are two specific types of nutraceuticals. It has been proved that phytochemicals found in foods may help to provide protection from diseases such as cancer, diabetes, heart disease, and hypertension, for example, carotenoids found in carrots. Antioxidants may be helpful in avoiding chronic diseases, by preventing oxidative damage in body. There are multiple different types of products that come under the category of nutraceuticals:

1. Dietary supplements
2. Functional foods
3. Medical foods
4. Farmaceuticals

3. TYPES OF MARINE NUTRACEUTICALS

Marine-derived bioactive peptides have been obtained widely by enzymatic hydrolysis of marine proteins (Kim and Wijesekara, 2010) and have shown to possess many physiological functions, including antioxidant, antihypertensive or ACE inhibition, anticoagulant, and antimicrobial activities.

In fermented marine food sauces, such as blue mussel sauce and oyster sauce, enzymatic hydrolysis has already been done by microorganisms, and bioactive peptides can be purified without further hydrolysis. In addition, marine processing by-products contain bioactive peptides with valuable functional properties. Sulfated polysaccharides (SPs) not only are chemically anionic and widespread in marine algae but also occur in animals, such as mammals and invertebrates.

Marine algae are the most important source of nonanimal SPs, and their chemical structures vary according to the species of algae, such as fucoidan in brown algae (Phaeophyceae), carrageenan in red algae (Rhodophyceae),

ulvan in green algae (Chlorophyceae). Phlorotannins are phenolic compounds formed by the polymerization of phloroglucinol or defined as 1,3,5-trihydroxybenzene monomer units and biosynthesized through the acetate–malonate pathway. They are highly hydrophilic components with a wide range of molecular sizes between 126 and 650,000 Da. Marine brown algae accumulate a variety of phloroglucinol- based polyphenols, as phlorotannins could be used as functional ingredients in nutraceuticals with potential health effects (Wijesekara *et al*., 2010).

Marine lipids provide unique health benefits to consumers and are highly prone to oxidation. Fucosterol, a phytosterol found in brown seaweeds, is well recognized for its health-beneficial biological activities, such as antioxidative, cholesterol-reducing, and antidiabetic properties. Fucosterol obtained from the n-hexane fraction of Pelvetia siliquosa (Phaeophyceae) is effective against free radical and CCl4-induced hepatotoxicity in vivo.

4. HEALTH BENEFITS OF MARINE NUTRACEUTICALS

Marine nutraceuticals might have a positive effect on human health as they can protect human body against damage by reactive oxygen species (ROS), which attack macromolecules such as membrane lipids, proteins, and DNA and lead to many health disorders such as cancer, diabetes mellitus, neurodegenerative and inflammatory diseases with severe tissue injuries. Recently, chito oligosaccharides (COS) have been the subject of increased attention in terms of their pharmaceutical and medicinal applications (Kim and Mendis, 2006), due to their missing toxicity and high solubility, as well as their positive physiological effects such as antioxidant, ACE enzyme inhibition, antimicrobial, anticancer, antidiabetic, hypocholesterolemic, hypoglycemic, anti-Alzheimer's, anticoagulant properties, and adipogenesis inhibition.

Carotenoids are thought to be responsible for the beneficial properties in preventing human diseases, including cardiovascular diseases, cancer, and other chronic diseases. Moreover, marine-derived sterols have received much attention in the last few years because of their cholesterol-lowering properties. Further, marine algal-derived SPs exhibited various health-beneficial biological activities such as anti-HIV-1, anticoagulant, immunomodulating, and anticancer activities (Wijesekara *et al*., 2011). Moreover, some bioactive peptides from marine organisms have been identified to possess nutraceutical potentials for human health promotion and disease risk reduction (Shahidi and Zhong, 2008), and recently the possible roles of food-derived bioactive peptides in reducing the risk of cardiovascular diseases have been demonstrated (Erdmann *et al*., 2008). In addition, saringosterol, a derivative of fucosterol, discovered in several brown algae (Phaeophyceae), such as Lessonia nigrescens and Sargassum ringgoldianum, has been shown to inhibit the growth of Mycobacterium tuberculosis.

5. NUTRITIONAL VALUE OF SEA LETTUCES

Seaweeds represent one of the most nutritious plant foods, and general utilization of seaweeds in food products has grown steadily since the early 1980s (Besada *et al*., 2009). Sea lettuces comprise the genus Ulva, a group of edible green seaweeds which is widely distributed along the coasts of the world's oceans and often found in the mid and upper tidal zones. They are easily identified by their paperthin, semi

translucent, and vibrant green color. Sea lettuces contain large amounts of polysaccharides, which constitute around 38%–54% of the dry matter. The protein content of sea lettuces varies with the species, but is generally present in high amounts. For example, protein content in Ulva reticulate is 21.06% of the dry weight, whereas higher protein contents (27.2% of the dry weight) are recorded in U. lactuca (Ortiz *et al*., 2006; Ratana-arporn and Chirapart, 2006). These levels are comparable to those found in high-protein terrestrial vegetables, such as soybeans, in which protein makes up 40% of the dry mass (Murata and Nakazoe, 2001). Sea lettuces are rich in nutrients with medicinal and health-promoting effects. From a nutritional standpoint, the main properties of sea lettuces are their richness in polysaccharides, proteins and amino acids, fatty acids, minerals, and vitamins. Therefore, their nutritional values make them valuable food supplements. Furthermore, sea lettuces may be used to fortify processed foods. Food preparation from sea lettuces worldwide may be studied to increase sea lettuce utilization. Moreover, recognition of sea lettuces as sources of diverse bioactive principles may open the medicinal potential of sea lettuces, and there is a great potential to be used in pharmaceuticals. Therefore, combination between culinary use and research on bioactive compounds may revitalize the use of sea lettuces in the new health-conscious consumers. Sea lettuce products could be used for food fortification, enrichment, and multipurpose applications.

6. CHITIN AND CHITOSAN

Chitin is an abundant natural polysaccharide, which can be found in the exoskeleton of crustaceans, cuticle of the insects, and cell wall of some microorganisms. Chitosan is a common derivative of chitin and gained by N-deacetylation in the presence of alkaline. Chitosan is reported to be a functional and basic linear polysaccharide. Generally, deacetylation cannot be completely achieved even under harsh treatment. The degree of deacetylation usually ranges from 70% to 95%, depending on the method used. Chitosan-based products are known to have many biological activities, such as antitumor, anti-HIV, antifungal, antibiotic, and act against oxidative stress (Artan *et al*. 2010; Kendra and Hadwiger 1984; Kim *et al*. 2008; Nishimura *et al*. 1998; Xie *et al*. 1999). Activities can be grouped into two according to the use of chitin-based products. These products are highly used as indirect helping agents to enhance the effectiveness of other active compounds through chemical modification or nonchemical linkage against diabetes and obesity. On the other hand, the main role of chitin-based products is to act as therapeutic nutraceutical agents directly against diabetes and obesity.

The number of patients diagnosed with diabetes is rapidly increasing in recent years. There is no cure for diabetes, and controlling the diabetic complications is not at the desired level. On the other hand, high mortality and morbidity of diabetes urge effective preventing and treatment methods to this disorder. Environmental and genetic factors, which lead to diabetes and impaired pancreatic functions in later stages, also have to be kept under control for improved prevention of diabetes onset. Chitosan, its monomer glucosamine, oligomeric derivative chitooligosaccharides, and other reported derivatives express highly efficient activity in a manner of lowering lipid accumulation and cholesterol as well as pancreatic β-cell protection. Reported evidences suggest that chitosan and its derivatives are promising lead compounds with highly potent utilization as nutraceuticals for treatment and prevention of diabetes and diabetes-related complications.

7. ABALONE

Abalone is a commercially important marine "archeogastropod" mollusk with characteristic single auriform shell under the family of Haliotidae (Lee and Vaequier, 1995). As a food, abalone has been in demand for a long time due to its rich nutritional value, superior taste, and various other benefits to human health among other mollusk species; hence, it is known as "the emperor of the seashells," "mother of shellfish," or "ginseng in the ocean" (Kim *et al*., 2006; Lee *et al*., 2010). There are 56 recognized abalone species that belong to the genus Haliotis; however, it is believed that there could be more than 100 species of abalones (Geiger, 2000).

8. CONCLUSION

With so many new species of marine resources still to be discovered, the potential for new marine-derived bioactive nutraceuticals is immense with beneficial effects on human health, and the food industry is poised for accelerated development in the near future. Marine resources have been well recognized for their biologically active substances with a great potential to be used as nutraceuticals. Moreover, much attention has been paid recently by the consumers toward healthy lifestyle with natural bioactive ingredients. Recent studies have provided evidence that marine-derived bioactive nutraceuticals play a vital role in human health.

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