

## Sea Cucumbers: More than A Luxury Delicacy

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Sea cucumbers are sea creatures, less glamorous cousins of sea stars and sea urchins, from the class Holothuroidea. Aristotle described them as a kind of “unattached” sea sponge [1]. They are marine invertebrates with a leathery skin and an elongated body containing a single, branched gonad. Sea cucumbers are mostly harvested in tropical and subtropical countries. Despite marine biologists call them “vacuum cleaners of sea floor” the use of sea cucumbers as a foodstuff, known as *bêche-de-mer* or *trepang*, has been a feature of Far and South East Asian culinary culture for centuries [2]. While sea cucumbers are often cut up for certain dishes, they are sometimes served whole. Hence, the size, color, shape, appearance and taste of the products are valued by consumers. Fifty-eight species are commonly exploited worldwide however there are regions with active fisheries (e.g Mediterranean basin) that are almost unknown, or they are fished only for sale to exporters as do not constitute part of the diet. The rising demand of the markets in Asia led to the depletion of local sea cucumbers populations and prompted Asian traders to solicit sea cucumbers from locations further afield. In addition, the prices for some rare species raised to extraordinary levels, thousands of dollars per kg of dried product [3].

Except the high demand and interest of the Asian market sea cucumbers have gained immense popularity among researchers and nutritionists focusing on their nutritional and potential health benefits for various diseases. Are we in front of another sea treasure? Sea cucumbers are nutrient factories, rich in protein and bioactive peptides, fatty acids, minerals, carotenoids, gelatins, vitamins and other more complex organic compounds. According to a Ming dynasty report (1368-1644 A.D.), the sea cucumber exhibits the same medicinal properties as the herb ginseng; in Mandarin it is called “haishen” which means “ocean ginseng”. There are a few reviews in the literature which cover the description of high value components and bioactive compounds as well as the nutritional properties of these multipurpose marine invertebrates [4-8]. As previously mentioned, most of the holothurians are rich in proteins, in the body wall there are higher amounts of high-quality protein than in the muscle bands, in some cases above 50%, whereas in muscle bands there are higher amounts of fatty acids. In general, in whole body fatty acid percentage doesn't exceed 5%. The main part of most sea cucumbers contains a high collagen and gelatin contents. The use of commercial enzymes to produce collagen from sea cucumbers appears to be a feasible process to convert an underutilized species to a more useful product that contains a functional ingredient for the food industry. However, further studies are needed to isolate and identify the specific peptides and/or amino acid sequences in sea cucumber collagen hydrolysates with functional activity for potential utilization in food production. Gelatins from sea cucumber is considered to be more valuable than gelatins from others organisms because of their characteristic amino acid composition, especially the essential amino acids.

Recently, fucosylated Chondroitin Sulfates were isolated from the body wall of *Holothurian Forskali* collected off the west coast of Scotland near Oban [9]. Fucosylated Chondroitin Sulfates exhibit strong anti-inflammatory activity and are considered as chondroprotective, while they are under clinical investigation for their therapeutic role in osteoarthritis [10]. Other scientists focus on specific species of sea cucumbers, with local interest, like the giant red sea cucumber, *Parastichopus californicus*, the only holothurian species harvested in Alaska [11]. Specific bioactive organic compounds like saponins, the main secondary metabolites, are extracted and the extracts tested for their antitumor activity [12], hypolipidemic activity as well as for their inhibition of fat accumulation which occurs in non-alcoholic

fatty liver disease, the most common chronic liver disease in the world [13-17]. However, the difficulty to isolate the saponin monomers due to their low levels as well as their strong hemolytic activity - intravenous injection cannot be directly applied, makes compulsory the development of a functional food or nutrient supplement. The daily consumption of a jelly containing a hydrolysate of the sea cucumber *Stichopus japonicus*, rich in saponins, in a double-blind randomized controlled study of elderly individuals in a nursing home reduced their oral Candida load [18-19].

Up to now, there are very few sea cucumbers-based products in the food supplement market. Fortification of food supplements with sea cucumber extracts would provide an opportune approach to make the sea cucumbers-based products popular in new markets. However, translating nutritional innovations into final products is a costly and complex process. This type of functional foods present major challenges in the food industry as they appear to be a new and unfamiliar territory for product developers in marketing and business strategies. In addition, once their health benefit effects are demonstrated, new aspects need to be address such as sea farming of sea cucumbers, production of functional ingredients at industrial scale, extraction and purification of functional ingredients. Hence, successful food supplements development is therefore a question of combining nutritional/ medical insight, technological capabilities, and a thorough understanding of consumers.

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