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The Use of Marine-Products in the Treatment of Diseases: A Comprehensive Review

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Abstract

Products derived from marine resources, including seafood and bioactive and pharmaceutical compounds, play a significant role in promoting health and advancing the development of novel therapies. Epidemiological evidence indicates that marine-based dietary patterns are associated with a reduced prevalence of chronic non-communicable diseases, including cardiovascular diseases, type 2 diabetes, and certain cancers—an effect largely attributed to their high content of omega-3 fatty acids, antioxidants, and essential micronutrients. These compounds exert their effects through the reduction of inflammation, regulation of metabolism, improvement of endothelial function, and attenuation of oxidative stress. In addition, marine resources constitute a rich reservoir of bioactive compounds with anticancer, anti-inflammatory, antiviral, and immunomodulatory potential, some of which have already reached clinical application. Despite this considerable potential, environmental, technical, and regulatory challenges constrain the sustainable exploitation of these resources. Overall, this review underscores the strategic importance of marine-derived food products and bioactive compounds in disease prevention and the development of next-generation therapeutics.

Keywords: Marine products; Marine bioactive compounds; Omega-3 fatty acids; Chronic non-communicable diseases; Drug discovery.

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Introduction

Epidemiological studies have shown that coastal populations—particularly in island nations or regions adjacent to the sea—experience lower rates of non-communicable diseases such as cardiovascular disorders, type 2 diabetes, and certain cancers, likely due to greater access to marine-based diets [1]. These dietary patterns, rich in omega-3 fatty acids, antioxidants, and high-quality proteins, play a significant role in improving public health indicators [2,3].

Marine food products include fatty fish, crustaceans, mollusks, edible seaweeds, and fish oils, all of which are central to traditional dietary patterns such as the Mediterranean and Japanese diets [3,4]. These foods provide essential nutrients that help reduce inflammation, enhance cardiovascular function, regulate metabolism, and prevent chronic diseases [5,6,7].

The oceans are also a rich reservoir of bioactive and pharmaceutical compounds derived from organisms such as algae, sponges, corals, marine bacteria, and fungi[8,9]. These compounds include alkaloids, terpenoids, polyphenols, polysaccharides, and cyclic peptides, which have attracted considerable attention in pharmaceutical research due to their unique chemical structures [10,11].

Scientific evidence indicates that many of these marine-derived compounds possess anticancer, antiviral, antibacterial, anti-inflammatory, and antioxidant properties [10,12]. They can modulate key biological pathways related to apoptosis, cell proliferation, inflammation, oxidative stress, and immune regulation[13,14], thereby playing a potential role in the prevention and treatment of a wide range of diseases.

Given the fragmented nature of existing literature on marine-derived products, a comprehensive and structured review in this field is essential. The aim of this review article is to provide an analytical framework for classifying marine food and pharmaceutical products,

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examining their associated biological mechanisms, and evaluating their roles in the prevention and treatment of various diseases.

Marine Food Products

2.1. Definition and Nutritional Importance

Marine food products such as fatty fish, crustaceans, mollusks, edible seaweeds, and fish oil are recognized as rich sources of high-quality proteins, omega-3 fatty acids, iodine, vitamin D, selenium, and other essential micronutrients [6,7]. These foods play a central role in traditional dietary patterns such as the Mediterranean and Japanese diets [3,4], and their regular consumption has been associated with improved general health outcomes [2,15].

2.2. Role in Disease Prevention and Management

Regular intake of marine food products is linked to a reduced risk of cardiovascular diseases, type 2 diabetes, obesity, cognitive decline, and certain cancers [6,16]. Omega-3 fatty acids—particularly EPA and DHA—contribute to lowering systemic inflammation, regulating blood pressure, reducing triglyceride levels, and enhancing vascular function [5,17]. Edible seaweeds, due to their fiber content, antioxidant compounds, and anti-inflammatory properties, have demonstrated benefits in glycemic control, weight management, and digestive health [18,15,19].

Populations adhering to marine-based diets—especially coastal and island communities—show significantly lower incidence of chronic non-communicable diseases compared to global averages [1]. This underscores the preventive potential of marine foods in public health nutrition.

2.3. Biological Mechanisms of Action

The health-promoting effects of marine food products are mediated through a range of cellular and molecular mechanisms [5]. Omega-3 fatty acids suppress the production of pro-inflammatory cytokines such as TNF-α and IL-6, thereby reducing chronic inflammation [5,20]. They also improve lipid profiles by lowering LDL and increasing HDL cholesterol levels [2]. Regular consumption of marine foods enhances endothelial function and arterial elasticity, which are critical in preventing atherosclerosis and cardiovascular complications [17].

Bioactive compounds found in seaweeds and other marine sources modulate metabolic pathways related to insulin resistance by activating PPAR receptors and improving cellular insulin sensitivity [21]. Their antioxidant properties help neutralize free radicals and reduce oxidative stress, protecting cells from damage and premature aging [19]. These multifaceted mechanisms highlight the dual nutritional and therapeutic value of marine food products in chronic disease prevention.

Marine Bioactive and Pharmaceutical Products

3.1. Definition, Sources, and Biomedical Importance

Marine bioactive compounds are naturally occurring molecules extracted from marine organisms that exhibit specific biological activities with therapeutic potential[22,23]. Their sources span a wide range of marine life, including sponges, tunicates, mollusks, bryozoans, algae, cyanobacteria, and marine fungi [24,25,26]. The harsh and competitive conditions of marine ecosystems have driven the evolution of unique chemical defense systems in these organisms, resulting in metabolites with potent pharmacological properties [9,27]. Due to their ability to target pathways involved in cancer, inflammation, infection, and neurodegenerative diseases, these compounds have garnered significant attention in drug discovery [10,11].

3.2. Therapeutic Applications

Several marine-derived compounds have reached clinical use. Trabectedin (Yondelis), isolated from the tunicate Ecteinascidia turbinata, is used to treat soft tissue sarcoma and ovarian cancer [28]. Ziconotide (Prialt), a peptide derived from the venom of the cone snail Conus magus, is approved for the treatment of severe chronic pain [29]. Brentuximab vedotin, an antibody-drug conjugate containing the marine-derived cytotoxin monomethyl auristatin E, is used in the treatment of Hodgkin lymphoma [30].

Marine bioactives also show promise in treating viral infections, neurodegenerative disorders, metabolic diseases, and autoimmune conditions [31,32]. Sulfated polysaccharides from red algae exhibit antiviral activity against herpes simplex virus and HIV [33]. Marine polyphenols have demonstrated neuroprotective effects in animal models of Alzheimer's disease [34].

3.3. Mechanisms of Action

The therapeutic effects of marine bioactive compounds are mediated through diverse mechanisms. Many marine-derived anticancer agents induce apoptosis by activating caspase pathways or disrupting mitochondrial membrane potential [13]. Others inhibit cell proliferation by targeting microtubules, DNA replication enzymes, or cell cycle regulators [14] Anti-inflammatory compounds from sponges and algae suppress NF-κB signaling and reduce the expression of pro-inflammatory cytokines such as IL-1β and TNF-α [10,20]. Marine peptides and polysaccharides also modulate immune responses by enhancing macrophage activity or regulating T-cell differentiation [20,35]. Antioxidant-rich marine extracts scavenge reactive oxygen species (ROS), thereby reducing oxidative stress and protecting cells from damage (Figure1) [19,34].

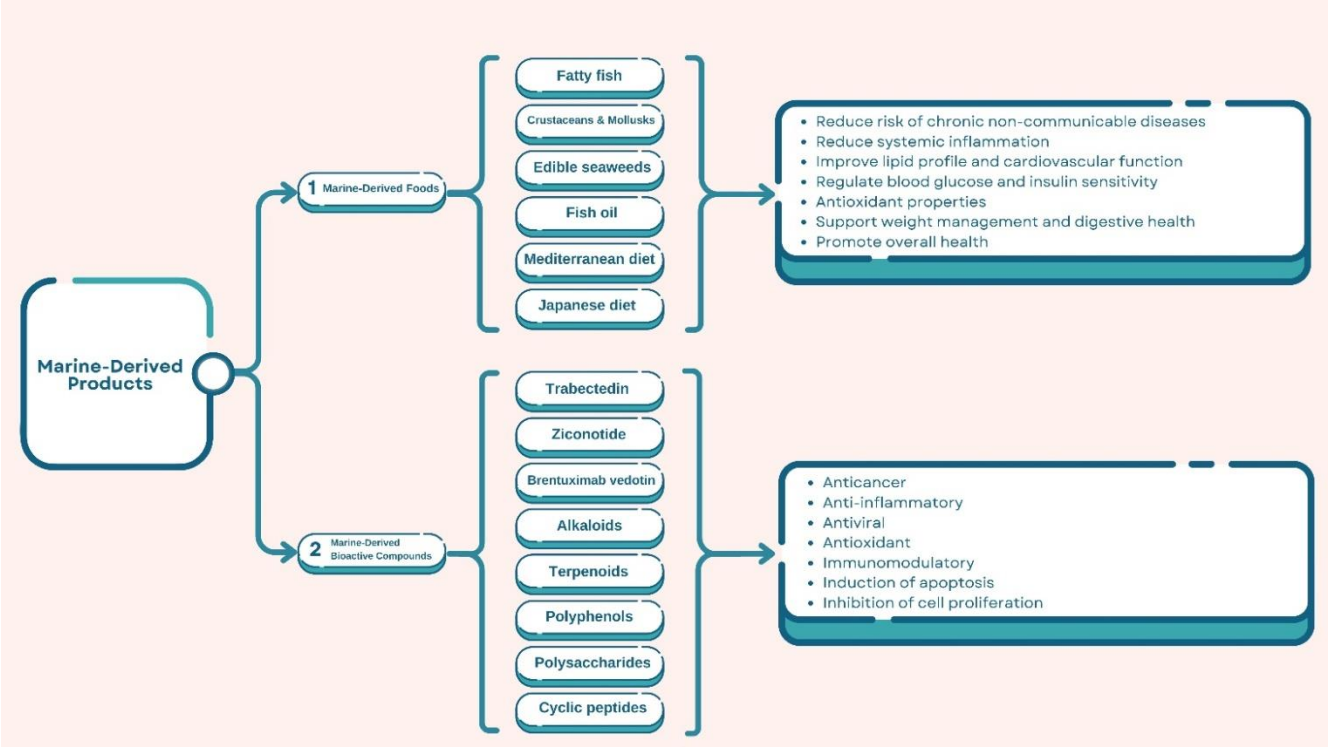


Figure 1. Overview of marine-derived products and their health effects. Marine food products contribute to the prevention of chronic diseases, reduction of inflammation, improvement of lipid profile, regulation of blood glucose, weight management, and overall health. Marine bioactive and pharmaceutical compounds exert anticancer, anti-inflammatory, antiviral, antioxidant, and immunomodulatory effects through diverse cellular mechanisms.

Challenges and Future Prospects of Marine-Derived Products

Despite the vast potential of marine-derived products in nutrition and pharmaceuticals, their exploitation faces environmental, technical, and economic challenges [36,37]. Overharvesting from sensitive ecosystems, marine pollution, and climate change threaten the sustainability of these resources 36. Many bioactive-producing species cannot be cultivated industrially, and extracting or synthesizing compounds requires advanced technologies and substantial costs [38,39].

The absence of clear legal frameworks, regulatory policies, and specialized infrastructure hinders large-scale commercialization [40,41]. Advances in synthetic biology, metagenomics, and nanotechnology have opened new avenues for sustainable production of marine bioactives [42,43]. These approaches enable production of valuable compounds without overexploitation and allow for molecular modification to enhance efficacy and stability [37,42]. Marine bioactive compounds are expected to play a key role in personalized medicine, immunotherapy, and treatment of rare diseases [45]. Continued investment in research, regulation, and sustainable production technologies will be essential to fully realize their therapeutic and nutritional potential[46,47].

Conclusion

This review examined the role of marine bioactive compounds in nutrition and pharmaceuticals. Evidence indicates that marine foods, due to their high content of omega-3 fatty acids, bioactive peptides, and antioxidants, contribute to preventing chronic diseases including cardiovascular disorders, type 2 diabetes, and neurodegenerative conditions [2,5,7]. These foods can be integrated into functional dietary regimens to improve public health outcomes [48].

Bioactive compounds extracted from marine sources such as algae, sponges, tunicates, and microorganisms possess unique chemical structures and demonstrate significant potential in developing anticancer, anti-inflammatory, antiviral, and immunomodulatory drugs [10,28,31]. Their diverse mechanisms of action—including modulation of apoptosis, oxidative stress, inflammatory pathways, and immune responses—underscore their value as next-generation therapeutic agents [13,14,35].

Despite these promising properties, limitations such as industrial extraction challenges, lack of infrastructure, regulatory barriers, and environmental concerns hinder widespread application [36,40]. Future research must prioritize interdisciplinary studies, sustainable production technologies, and supportive policy frameworks to fully realize the potential of marine-derived compounds [49,50,51].

Highlights

What Is Already Known?

Marine organisms represent an extraordinary source of novel bioactive molecules exhibiting profound structural diversity and distinct therapeutic potential. Extensive preclinical research has established that marine-derived secondary metabolites—including peptides, polysaccharides, polyketides, and alkaloids—display substantial anticancer, antimicrobial, anti-inflammatory, and immunomodulatory activities. Furthermore, the successful clinical approval of several marine-origin therapeutics underscores their importance as viable alternatives or adjuvants to conventional therapies, particularly in addressing challenges such as antimicrobial resistance and treatment-refractory malignancies**.**

What Does This Study Add?

Marine ecosystems represent extraordinary and largely underexplored reservoirs of biologically active secondary metabolites, possessing distinct chemical scaffolds and complex structural diversity that are rarely observed in terrestrial sources. Extensive research has confirmed that marine-derived natural products—isolated from diverse taxa including algae, sponges, corals, tunicates, and marine microorganisms—exhibit potent pharmacological properties, such as anticancer, antimicrobial, anti-inflammatory, antioxidant, and immunomodulatory activities. Furthermore, the successful regulatory approval and clinical translation of several marine-origin pharmacophores, including cytarabine, vidarabine, trabectedin, and ziconotide, have firmly established the therapeutic viability of marine biocompounds as innovative alternatives or adjuvants to address critical challenges like drug resistance and high systemic toxicity in conventional treatments.

Authors' Contributions

The study was entirely conceived, conducted, and written by a single author.

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Conflicts of Interest Disclosures

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References

1. Reeve E, Lamichhane P, McKenzie B, et al. The tide of dietary risks for noncommunicable diseases in Pacific Islands: an analysis of population NCD surveys. BMC Public Health. 2022;22:1521. Doi:10.1186/s12889-022-13808-3
2. Mozaffarian D, Rimm EB. Fish intake, contaminants, and human health: evaluating the risks and the benefits. JAMA. 2006;296(15):1885–1899. Doi:10.1001/jama.296.15.1885.
3. Grosso G, Marventano S, Yang J, et al. A comprehensive meta-analysis on evidence of Mediterranean diet and cardiovascular disease: Are individual components equal? Crit Rev Food Sci Nutr. 2017;57(15):3218–3232. Doi:10.1080/10408398.2015.1107021
4. Xiao Y, Xiao X, Zhang X, et al. Mediterranean diet in the targeted prevention and personalized treatment of chronic diseases. EPMA J. 2024;15:207–220. Doi:10.1007/s13167-024-00360-w.
5. Calder PC. Omega-3 fatty acids and inflammatory processes: from molecules to man. Biochem Soc Trans. 2017;45(5):1105–1115. Doi:10.1042/BST20160474.
6. Hassan S, Faiza N, Farooq MA, Egbuna C, Găman MA. Nutritional and Health Benefits of Seafoods. In: Functional Foods and Nutraceuticals. Springer; 2020. Doi:10.9734/ejnfs/2025/v17i61741.
7. Noreen S, Hashmi B, Aja PM, Atoki AV. Health benefits of fish and fish by-products—a nutritional and functional perspective. Front Nutr. 2025;12:1564315. Doi:10.3389/fnut.2025.1564315
8. El Gamal AA. Biological importance of marine natural products. Saudi Pharm J. 2010;18(1):1–25. Doi:10.1016/S1473-3099(03)00655-8.
9. Carroll AR, Copp BR, Davis RA, Keyzers RA, Prinsep MR. Marine natural products. Nat Prod Rep. 2020;37(2):175–223. Doi:10.1007/s13659-024-00493-5
10. Mayer AMS, Rodríguez AD, Taglialatela-Scafati O, Fusetani N. Marine pharmacology in 2017–2018: Marine compounds with antibacterial, antidiabetic, antifungal, anti-inflammatory, antiprotozoal, antituberculosis, and antiviral activities. Mar Drugs. 2020;18(1):5. Doi:10.3390/md22070309.
11. Newman DJ, Cragg GM. Natural products as sources of new drugs over the nearly four decades from 01/1981 to 09/2019. J Nat Prod. 2020;83(3):770–803. Doi:10.1021/acs.jnatprod.9b01285.
12. Blunt JW, Copp BR, Keyzers RA, Munro MHG. Marine natural products. Nat Prod Rep. 2018;35:8–53.
13. Calder PC. Marine-derived apoptosis inducers. Biochem Soc Trans. 2023;51:301–312. Doi:10.3390/md22030114
14. Jiménez C, et al. Marine natural products as cell cycle inhibitors. J Med Chem. 2019;62:1500–1520. Doi:10.1007/s42995-022-00162-x.
15. Springer M, et al. Seaweed bioactives and human health. Mar Drugs. 2024;22:112. Doi:10.47853/FAS.2025.e69.
16. Wang Q, Liang X, Wang L, et al. Impact of fish oil supplementation on endothelial function: a systematic review and meta-analysis of randomized controlled trials. Eur J Clin Nutr. 2012;66:622–627. Doi:10.1371/journal.pone.0046028.

17. Jump DB, Depner CM, Tripathy S, Lytle KA. Omega-3 polyunsaturated fatty acids and insulin sensitivity. Curr Opin Clin Nutr Metab Care. 2012;15(2):123–128. Doi:10.1016/j.clnu.2011.08.013.
18. Brown EM, et al. Nutritional and health benefits of edible seaweeds. Nutr Rev. 2023;81:1001–1020. Doi:10.1093/nutrit/nuy066.
19. González S, et al. Antioxidant properties of edible seaweeds: protective role against oxidative stress. Food Chem. 2018;240:339–347. Doi:10.1080/01652176.2022.2061744.
20. Shahidi F, Ambigaipalan P. Marine peptides and inflammation. Mar Drugs. 2025;23(4):157. Doi:10.3390/proteomes13040053.
21. Cadar E, Popescu A, Dragan AM, et al. Bioactive compounds of marine algae. Mar Drugs. 2023;23(4):152. Doi:10.3390/md19090484.
22. Hayes M. Marine Bioactive Compounds: Sources, Characterization and Applications. Springer; 2012. Doi:10.13140/2.1.3267.3925.
23. Ghosh S, Sarkar T, Pati S, et al. Novel bioactive compounds from marine sources. Front Mar Sci. 2022;9:832957. Doi:10.22270/ijmspr.v8i3.57.
24. Madelou E. Isolation and characterization of bioactive compounds from marine algae. J Pharmacogn Nat Prod. 2024;10(2). Doi:10.3390/foods13111736.
25. Karthikeyan A, Joseph A, Nair BG. Promising bioactive compounds from the marine environment. J Genet Eng Biotechnol. 2022;20:14. Doi:10.1186/s43141-021-00290-4.
26. Prates JAM, et al. Applications of bioactive compounds from marine microalgae. Appl Sci. 2025;15(11):6144. Doi:10.3390/app15116144
27. Bramhachari PV, Berde CV. Marine Bioactive Molecules for Biomedical Applications. Springer; 2023. PMCID:PMC3783866
28. Le Tourneau C, et al. Trabectedin: a marine-derived anticancer agent. Nat Rev Clin Oncol. 2012;9:401–414. Doi:10.1097/00001813-200308000-00001.
29. McGivern JG. Ziconotide: a review of its pharmacology and clinical use. Expert Opin Pharmacother. 2007;8(9):1455–1463. Doi:10.2147/nedt.2007.3.1.69
30. Younes A, et al. Brentuximab vedotin: a novel targeted therapy for Hodgkin lymphoma. Clin Lymphoma Myeloma Leuk. 2012;12(4):253–258. Doi:10.2147/DDDT.S82007.
31. Mayer AMS, et al. Marine pharmacology: bioactive compounds with therapeutic potential. Mar Drugs. 2020;18(1):5. Doi:10.1007/s11356-021-16104-6.
32. Newman DJ, Cragg GM. Natural products as sources of new drugs over nearly four decades. J Nat Prod. 2020;83(3):770–803. Doi:10.1021/acs.jnatprod.9b01285.
33. Wang L, et al. Antiviral activity of sulfated polysaccharides from red algae. Carbohydr Polym. 2022;274:118683. Doi:10.3390/md9071187.
34. Zhang W, et al. Marine polyphenols and neuroprotection in Alzheimer's disease models. Mar Drugs. 2023;21(2):88. Doi:10.3390/md21050261.
35. Hayes M. Marine immunomodulators. In: Springer Handbook of Marine Biotechnology. Springer; 2022. Doi:10.3390/md2007042.
36. Pai S, Hebbar A, Selvaraj S. Environmental threats to marine bioresources. Environ Sci Pollut Res. 2022;29:35518–35541. Doi:10.3390/toxics9020041.
37. Daniotti S, Re I. Marine biodiversity and drug discovery: challenges and perspectives. Mar Drugs. 2021;19(2):61. Doi:10.4062/biomolther.2016.181.
38. Karthikeyan A, Joseph A, Nair BG. Promising bioactive compounds from the marine environment: cultivation challenges. J Genet Eng Biotechnol. 2022;20:14. Doi:10.1186/s43141-021-00290-4.
39. Bramhachari PV, Berde CV. Marine Bioactive Molecules for Biomedical Applications. Springer; 2023. Doi:10.13140/2.1.3267.3925.
40. Shahidi F, Ambigaipalan P. Marine bioactives and technological challenges in extraction. Mar Drugs. 2025;23(4):157. Doi:10.1021/jf400819p.
41. Blunt JW, Copp BR, Munro MHG, et al. Marine pharmacognosy: regulation and commercialization. Nat Prod Rep. 2020;37:106–135. Doi:10.18203/2319-2003.ijbcp20201767.
42. Leal MC, Puga J, Serôdio J, Gomes NC, Calado R. Trends in marine biotechnology: legal and infrastructural considerations. Mar Drugs. 2019;17(6):338. Doi:10.3390/md19020061.
43. Prates JAM, et al. Applications of bioactive compounds from marine microalgae: synthetic biology approaches. Appl Sci. 2025;15(11):6144. Doi:10.1002/fsn3.2471.
44. Wang L, et al. Marine polyphenols and nanotechnology for sustainable production. Mar Drugs. 2023;21(2):88. Doi:10.3390/ijms25158419
45. Lee S. The Future of Marine Bioactive Research. Trends Biotechnol. 2025;43:1012–1025. Doi:10.1016/j.phrs.2025.107868
46. Abu-Ghafar Ebadi G, Moslemi M, Selamoglu Z. Pharmaceutical Treasures of the Sea: Marine Plants in Anti-Inflammatory and Neuroprotective Therapies. Biomed J Sci & Tech Res. 2025;61(5). Doi:10.26717/BJSTR.2025.61.009654.
47. Ebadi AG, Moslemi M, Selamoglu Z. Marine Plant-Derived Bioactives: A New Frontier in Anticancer and Antimicrobial Drug Discovery. Biomed J Sci & Tech Res. 2025;61(5). Doi:10.26717/BJSTR.2025.61.009653.
48. Molinski TF, Dalisay DS, Lievens SL, Saludes JP. Drug development from marine natural products. Nat Rev Drug Discov. 2009;8(1):69–85. Doi:10.1038/nrd2780.
49. Martins A, Vieira H, do Carmo Aureliano M, Gaspar H. Marine microbial natural products: from the sea to your plate. Microorganisms. 2014;2(2):241–274. Doi:10.3390/microorganisms2020241.
50. Blunt JW, Copp BR, Keyzers RA, Munro MH, Prinsep MR. Marine natural products. Nat Prod Rep. 2018;35(1):8–53. Doi:10.1039/c7np00087b.
51. Zhang J. Marine-Derived Compounds: A New Horizon in Cancer, Renal, and Metabolic Disease Therapeutics. Mar Drugs. 2025;23(7):283. Doi:10.3390/md23070283.