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Editorial

Production and Biomedical Applications of Bioactive Compounds

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The development of drug resistance to presently available synthetic medicines leads us to investigate naturally produced small bioactive molecules to treat drug-resistant diseases, such as cancer and other diseases. Biomolecules originate from natural sources, including plants, microbes, and animals. According to the available studies, bioactive components can enhance pharmacological efficacy at lower doses, hence decreasing dosage toxicity [1]. The bioactive compounds from edible and medicinal plants use anti-cancer activities by obstructing the distinct tumorigenic stages. Bioactive compounds, such as alkaloids, isoprenoids, phenylpropanoids, xanthones, peptides, polysaccharides, glucosinolates, curcumin, resveratrol, anthraquinones, bilirubin, betaxanthin, betacyanin, lycopene, phytosterols, and β-sitosterol, have demonstrated efficacy against a variety of diseases owing to their pharmacological activities, such as HIV, hepatitis, COVID-19, anti-virus, anti-fungal, anti-bacterial, anti-oxidant, anti-cancer, anti-diabetic, anti-dysenteric, anti-inflammatory, anti-ulcer, anti-inflammatory, eye disorders, Alzheimer's, Parkinson's, osteoarthritis, cerebrovascular, chronic obstructive pulmonary, and coronary artery diseases [2–10]. Using nanotechnology can enhance the delivery of natural substances with demonstrated medicinal potential [11]. Specifically, the inclusion of natural compounds into nanoparticles (NPs) can boost their bioactivity, enhance targeting to the appropriate tissues or receptors, and permit the regulated release of substances over extended periods [12]. This Special Issue aims to provide scientific information on all areas of bioactive compounds with therapeutic benefits. This Special Issue contains 14 articles covering diverse biological impacts of natural products and their derived chemicals on various diseases.

Using HPLC-PDA and UHPLC-MS analysis, phenolic compounds, such as 3-OH benzoic, p-hydroxybenzoic, syringic acids, naringin, flavonoids, terpenoids, and alkaloids were quantified in *Buxus papillosa* [13]. In enzyme activity, moderate inhibition was identified, that can be linked to bioactive compounds [13]. This plant species could be investigated further as a potential source for developing new natural-product-derived drug candidates [13]. *Abutilon figarianum* was studied for various enzymes in treating Alzheimer's disease, type II diabetes, and skin hyperpigmentation problems [14]. Six distinct in vitro biological experiments were used to investigate the anti-oxidant potential [14]. Similarly, total bioactive components and UHPLC-MS secondary metabolite profiling were used to determine chemical composition, followed by in silico docking experiments [14]. Natural okra gum was isolated, thiolated, and examined for its muco-adhesion properties and role in increasing the efficacy of repaglinide as a model medication of short-acting Type II anti-diabetic drug [15]. The effects of extraction period, extraction temperature, and ultrasonic power on the recovery of carotenoids and anti-oxidant capacity from the peel of Gac fruit (*Momordica cochinchinensis* Spreng.) were investigated using the response surface methodology with the Box–Behnken design. To enhance the recovery of total carotenoid content and anti-oxidant capability from Gac peel, the optimum values of these extraction parameters were also determined [16]. Anti-HSV investigation on compounds derived from marine algae, particularly sulfated polysaccharides, along with their mode of action,

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with the goal of developing them as innovative potential anti-HSV agents [17]. In this Special Issue, there are a few articles that are all about finding bioactive compounds.

Biologically approaches to nanoparticle synthesis have received a lot of interest in biomedical research for producing unique and improved items for health diagnostics in various therapies. Because of their effective antimicrobial activity and low toxicity, silver NPs (AgNPs) have an extensive range of in vitro and in vivo uses. Furthermore, AgNPs enhanced by herbal extracts be active cytotoxicity agents. AgNPs synthesized through Asian spider flower plant extract could be used as potential therapeutic medications for human cancer cells [18]. The biosynthesis of AgNPs using *Myrtus communis* and its anti-cancer activity on HepG2 [19]. Compared to the chemically synthesized silver nanoparticles (AgNPs-C), the green synthesized silver nanoparticles bee pollen extract (AgNPs-G) exhibited superior anti-bacterial activity. In addition, the anti-cancer activity of AgNPs against human liver and breast carcinoma cell lines was investigated using the MTT-assay [20]. The findings of this study suggest that *Nigella sativa*-AgNPs should be explored for use in biomedical applications, alternative therapies, the design of anti-biofilm medicines, the treatment of multidrug-resistant bacterial infections, and anti-cancer therapies [21]. Phenotypic plasticity studies showed that the metal-ligand that was made increases the ability to kill bacteria by strongly attaching to the walls of bacteria [22]. This exhibits the series of $CoNd_xFe_{2-x}O_4$ NPs activity against *Candida albicans* and *Staphylococcus aureus* and supports its potential use in biological applications [22]. The metabolic regulation of ajmalicine synthesis by identifying the regulatory gene controlling ajmalicine flux via the FRET-based ajmalicine nanosensor [23]. The coaxial electrospray method can be used to form covalently cross-linked nanoparticles from arabinoxylans (AX) extracted from dried distillers' grains with solubles (DDGS). As a result, the formation of nanoparticles AX (NAX) from DDGS may represent both long-term bioethanol waste disposal and the production of appealing improved nanomaterial fabrication with potential pharmaceutical and biomedical applications, such as colon targeted drug delivery [24]. The use of nanoparticles in the medical sector is rapidly expanding. It has a high potential for overcoming toxicity challenges and can effectively target many organs and cell types. Though, the difficulty is to confirm that resveratrol is delivered to targeted organs and has the preferred impact [12]. Understanding the molecular mechanism will therefore aid in the design of nanoparticles for drug delivery to deliver drug confirmation for specific disorders. Preparation of natural nanoparticles to encapsulate resveratrol against many diseases. Furthermore, the application of RES-nanoparticles will only become a reality if the FDA's strict standards are met [12]. Recent research has been on carbon-based nanoparticles and their applications in cancer treatment, biosensors, and drug delivery [25]. The development of covalently and altered carbon-based nanomaterials contributes to the achievement of new challenges in preclinical biomedical applications [25] and the achievement of positive outcomes in various therapies. Several articles in this Special Issue focus on the synthesis of nanoparticles from bioactive compounds, the biological synthesis of nanoparticles for biomedical applications, and nanoformulations of bioactive compounds.

The significant side effects and high expenses of infectious and chronic diseases drugs indicate a need for alternative safe and potentially effective drugs derived from natural sources. The evidence suggested that the naturally derived bioactive compounds displayed multiple effects and acted coordinatively to target various disease pathways concurrently. Network and systems pharmacology approaches should be carried out to screen large-scale bioactive compounds for their anti-diabetic, anti-cancer, anti-inflammatory, anti-HIV, anti-COVID, etc., which can be further validated using in vitro and in vivo studies to harvest their benefits. Furthermore, the nanoformulations of bioactive compounds could be an ideal approach to enhance their biomedical applications against various diseases via increased bioavailability and targeted delivery.

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