Current Research in Pharmacy and Pharmaceutical Sciences IV

Editors

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PREFACE

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Chapter 1

THE RISE OF COSMECEUTICALS AND THE DECLINE OF AESTHETIC SURGERY

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Emrah ÖZAKAR[2]
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1. Introduction

Today, people's interest in and care for their appearance and personal grooming is increasing. Thanks to social media within digital platforms, the perception of beauty has become more visible, and the ideal body image has been instilled in people. As a result, individuals have begun to turn to various aesthetic procedures and the use of cosmetic products to improve their physical appearance. While surgical operations can provide noticeable changes in appearance in a short time, aesthetic surgical procedures bring with them some disadvantages such as unwanted side effects after the procedure, risk of infection, cost, and a long recovery period. Due to these negative reasons, we are seeing a rise in cosmeceutical products that offer lower risks, are safer in terms of health, and provide long-term, lasting effects, for people who want to change their physical appearance or achieve an aesthetic look. People are increasingly using cosmeceutical products for purposes such as reducing signs of aging, strengthening the skin barrier, protecting the skin from the harmful effects of sunlight, increasing skin elasticity, addressing hair and scalp problems, evening out skin tone, and reducing acne formation. The rise of cosmeceutical products has begun with the concept of longevity, which has gained increasing attention in recent years. Longevity is not just about aiming for people to live longer; it's a concept that promotes increased physical activity, health, and quality of life throughout one's lifetime. While classic cosmetic products only

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Chapter 2

ADVANCED PHARMACEUTICAL FORMULATIONS OF VERBASCOSIDE FOR WOUND HEALING

Betül KURT[1]
Esra PEZİK[2]

1. Introduction

In recent years, the increasing interest in natural components has enhanced the importance of plant-derived bioactive molecules, particularly in the field of wound healing. Wound healing is a multi-stage repair process regulated by cellular and biochemical mechanisms (1). Increased oxidative stress and uncontrolled prolongation of the inflammatory response can disrupt the physiological course of this process, leading to delayed healing (2). Verbascoside (VRB), belonging to the phenylethanoid glycosides group, is a naturally occurring compound first isolated from the species *Verbascum sinuatum* L. (3). VRB's antioxidant and anti-inflammatory effects have been demonstrated in various experimental studies; it has been reported to exhibit biological activity through the suppression of reactive oxygen species (ROS) and the regulation of inflammatory pathways (4, 5). Its antimicrobial potential has also been reported in the literature (6, 7). However, the hydrophilic nature of VRB and its sensitivity to environmental factors limit its bioavailability and stability (8, 9). Therefore, advanced topical carrier systems such as nanovesicular systems, nanofibers, and microemulsions have gained importance in terms of protecting the active compound, its controlled release at the target tissue site, and increasing its dermal penetration (10-12). In this context, supplementing natural phenolic compounds with pharmaceutical carrier systems is considered a strategic approach for optimizing biological activity and enhancing therapeutic performance (1). In this section, the role of VRB in wound healing

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applications. In this regard, advanced topical approaches such as nanofiber-based wound dressings, microemulsion systems, and nanovesicular carriers offer significant advantages in maintaining VRB stability, ensuring controlled release, and increasing skin penetration. VRB formulations supported by advanced carrier systems have the potential to create innovative product candidates for chronic wounds, diabetic ulcers, and inflammatory-based skin injuries. Completing certain fundamental research and development steps is necessary for this potential to translate into tangible products at the clinical and industrial levels. It is particularly important to thoroughly elucidate the pharmacokinetic properties of VRB, determine the optimal dose range, support long-term safety data, and ensure the standardization of formulations. Furthermore, clarifying the scalability of production processes and quality control parameters plays a critical role in meeting regulatory requirements. Strengthening this scientific and technological infrastructure will enable the transfer of innovative VRB-based wound care products to clinical practice and their sustainable development on an industrial scale.

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Chapter 3

BEYOND BUILDING BLOCKS: AMINO ACIDS IN THERAPEUTIC DESIGN

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1. Introduction

As the fundamental building blocks of proteins, peptides, and numerous bioactive peptidomimetic molecules, amino acids are the most critical components determining the architecture and functionality of biological systems. From a chemical perspective, their general formula consists of four fundamental groups attached to a central α-carbon atom: an amino group, a carboxyl group, a hydrogen atom, and a variable side chain that makes each amino acid unique. This fundamental architecture imparts both acidic and basic character to amino acids, placing them at the center of biochemical reactions and macromolecular folding (1) .

Except for glycine, the α-carbon atom of all proteinogenic amino acids acts as a chiral center because it is bonded to four different chemical groups. This causes the molecules to exist as two optical isomers in the form of non-superimposable mirror images of each other, depending on their three-dimensional spatial orientations. While the form participating in the structure of natural proteins and functioning in ribosomal protein synthesis is the L-configuration, the D-configuration, though not directly proteinogenic, plays critical roles in certain bacterial cell wall peptidoglycans and natural peptide antibiotics. Glycine, whose side chain consists solely of a hydrogen atom, is the only proteinogenic amino acid that does not exhibit chirality, thereby gaining unique conformational flexibility and rotational freedom in the protein backbone (2–4) .

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Chapter 4

BOTANICAL AUTHENTICATION, EXTRACTION AND PHYTOCHEMICAL CHARACTERIZATION OF MEDICINAL PLANTS

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1. Introduction

Medicinal plants remain a major source of structurally diverse natural products and continue to contribute to pharmaceutical discovery, phytotherapy, nutraceutical development, cosmetics, functional foods and other health-related applications. The renewed scientific interest in plant-derived natural products has been supported by advances in chromatography, high-resolution mass spectrometry, nuclear magnetic resonance (NMR), metabolomics, chemometrics and bioactivity-guided discovery. At the same time, these advances have made a longstanding problem more visible: a sophisticated analytical platform cannot compensate for inadequately identified, poorly documented or chemically undefined starting material. The reproducibility of medicinal-plant research therefore depends on a traceable chain that begins with botanical identity and extends through collection, voucher documentation, pre-processing, extraction, chemical characterization and, ultimately, biological evaluation (1-4).

Botanical materials are intrinsically heterogeneous. Genotype, chemotype, geographic origin, soil, climate, altitude, cultivation practice, developmental stage, harvesting season, plant organ, post-harvest handling and storage can alter both the abundance and relative distribution of specialized metabolites. This variability is not merely a taxonomic issue; it changes the chemical material that reaches an analytical instrument or biological assay. Consequently, the expression

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rational marker quantification provides a stronger foundation for reproducible phytochemical and biological research and for the development of standardized botanical products.

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Chapter 5

GADOLINIUM-BASED CONTRAST AGENTS IN MAGNETIC RESONANCE IMAGING (MRI)

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1. Introduction

Magnetic resonance imaging (MRI) is a non-invasive medical imaging modality that does not involve ionizing radiation and exploits the magnetic properties of hydrogen nuclei (protons), particularly those present in biological tissues, through the application of a strong static magnetic field and radiofrequency (RF) electromagnetic waves. In addition to providing detailed anatomical information, MRI can provide valuable insights into the physiological and functional characteristics of tissues, making it one of the most important imaging modalities in modern medicine. The availability of various imaging sequences and contrast mechanisms has enabled MRI to be widely used for the assessment of the central nervous system, musculoskeletal system, cardiovascular system, liver, kidneys, and a broad range of tumors (1).

One of the major advantages of MRI is the absence of ionizing radiation combined with its high soft-tissue contrast. These characteristics distinguish MRI from imaging modalities such as computed tomography (CT), particularly in the evaluation of the brain, spinal cord, muscles, joints, liver, and other soft tissues. Moreover, MRI enables image acquisition in multiple anatomical planes, including axial, sagittal, and coronal orientations. The use of different imaging sequences further allows the acquisition of multiparametric information from the same anatomical region, thereby facilitating a more comprehensive characterization of tissues and pathological processes (2, 3).

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distinct coordination environments, while structural modifications such as ligand rigidification, incorporation of bridging units, steric substitution, and optimization of hydration and water-exchange properties offer opportunities to modulate complex stability and relaxivity. In particular, macrocyclic architectures and appropriately designed ligand frameworks can provide high kinetic inertness and favorable physicochemical properties. At the same time, the development of high-relaxivity agents and bifunctional, macromolecular, polymeric, and targeted Gd complexes has expanded the potential applications of these systems beyond conventional anatomical imaging.

The development of next-generation GBCAs requires careful consideration of gadolinium retention, renal safety, transmetallation resistance, and the balance between relaxivity and molecular stability. Continued integration of coordination chemistry, medicinal chemistry, materials science, molecular imaging, and biomedical research is therefore expected to support the development of safer, more effective, and increasingly target-specific gadolinium-based MRI contrast agents.

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Chapter 6

BIOLOGICAL ACTIVITIES OF MEDICINAL PLANTS: FROM IN VITRO EVALUATION TO MECHANISMS AND TRANSLATIONAL RELEVANCE

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1. Introduction

Medicinal plants contain chemically diverse natural products that can interact with microorganisms, reactive species, enzymes, mammalian cells and signaling pathways. These interactions have generated a large literature describing antimicrobial, antioxidant, cytotoxic, anticancer, anti-inflammatory and enzyme-inhibitory activities. Natural products continue to provide important starting points for drug discovery, but the biological significance of a plant extract cannot be established by a single screening result. Botanical identity, extraction history, chemical composition, assay design, concentration range, positive and negative controls, and the biological model all influence the observed response (1,2).

The term 'biological activity' is therefore best understood as an experimentally defined property of a particular preparation under specified conditions. A hydroalcoholic extract that inhibits bacterial growth at a defined minimum inhibitory concentration (MIC), scavenges DPPH (2,2-diphenyl-1-picrylhydrazyl) radicals, or reduces the metabolic signal of a cancer cell line provides three different types of information; none is automatically interchangeable with therapeutic efficacy. The strongest medicinal-plant studies connect authenticated and chemically characterized material with assays that answer clearly stated biological questions and use orthogonal methods when assay interference is plausible (1,2).

Antimicrobial and antioxidant testing are among the most frequently reported activities in medicinal-plant research. Plant-derived alkaloids, phenolics,

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Chapter 7

CURRENT TRENDS IN DIETARY SUPPLEMENT TOXICITY: EPIDEMIOLOGICAL DATA AND STATISTICAL RISK ANALYSES

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1. INTRODUCTION

Dietary supplements form a broad product group made up of vitamins, minerals, amino acids, botanical constituents, probiotics and concentrated compounds with a range of biological activities. They are most often taken to protect health, to improve performance, to control weight, or to support sleep, energy or immune function. The frequency with which they are used, their availability without prescription, the spread of online sales channels and the widespread assumption that a natural product is by definition a safe one have all made supplement toxicity a steadily more important question for clinical toxicology, public health and risk management. In the National Health and Nutrition Examination Survey conducted in the United States, 57.6% of adults reported using at least one dietary supplement in the previous 30 days during the 2017-2018 period; the figure reached 63.8% among women and 80.2% among women over 60 years of age (1). More recent NCHS data show that between August 2021 and August 2023, 60.2% of adults had used at least one supplement in the previous 30 days, with the proportion rising to 66.1% in women and to 75.9% in adults aged 60 years and over (2).

Supplement-related toxicity cannot be explained by exceeding the recommended dose alone. The pharmacological activity of the active constituent, the simultaneous use of several products, drug-supplement interactions, chronic

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Algorithmic signals should nevertheless be used as decision support tools that set priorities for clinical toxicological evaluation, not as a substitute for it (4,35).

9. CONCLUSION

Dietary supplement toxicity is a public health problem that lies at the intersection of widespread use and heterogeneous product composition, and that involves methodological difficulties different from those of classical drug safety. Current epidemiological data show that the leading areas of risk are cardiovascular events related to weight-loss and energy products in young adults, problems associated with micronutrient use in older people, accidental exposure in children, and hepatotoxicity in herbal products.

Case numbers alone are not sufficient to determine the true burden of adverse events. Incidence and relative risk analyses based on an exposure denominator, multivariable models, and signal methods such as ROR, PRR, IC, EBGM and CUSUM applied to spontaneous reporting data are complementary tools. Rather than accepting a statistical signal as causality in itself, the current approach uses a multi-layered risk assessment model in which the signal is confirmed by clinical, biological, temporal and analytical evidence.

An effective system for dietary supplement safety should therefore rest on accurate product identification, standard adverse event reporting, sound epidemiological denominators, modern statistical signal analysis and rapid regulatory feedback. This integrated approach will allow rare but serious toxicities to be recognised early and will protect consumers from unnecessary risk.

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Chapter 8

BIFIDOBACTERIUM LONGUM AND ITS POTENTIAL ROLE IN COLORECTAL CANCER

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1. Introduction

Cancer is one of the most significant health problems worldwide, and its global burden continues to increase due to its rising incidence and high mortality rates. Cancer development is influenced by numerous factors, including environmental exposures, dietary habits, genetic predisposition, and lifestyle factors. In recent years, there has been increasing evidence that the gut ecosystem also plays a significant role in the initiation and progression of cancer. Probiotics consist of live microorganisms that, when consumed in sufficient quantities, can support host health. Their beneficial effects occur through various biological processes, including the restoration of gut microbial balance, inhibition of pathogenic bacteria, and regulation of host immune responses. Currently, the potential effects of probiotics are being investigated beyond their established roles in gastrointestinal health, particularly in relation to cancer and other diseases. In this context, the anti-cancer effects of probiotics have been linked to various mechanisms such as reducing inflammation, enhancing immune responses, and modulating the tumor microenvironment. The number of studies investigating the relationship between cancer and probiotics has increased significantly in recent years. However, the effects of probiotics can vary depending on the probiotic strain, dose, duration of administration, and type of cancer. Therefore, specific aspects of probiotic use need to be examined in more detail to clarify their potential roles in cancer prevention

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Chapter 9

FROM RITUALS TO MEDICINE: THERAPEUTIC POTENTIAL AND ETHICAL CHALLENGES OF HALLUCINOGENS

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Introduction

Alkaloids constitute a structurally diverse group of naturally occurring bioactive substances recognized for their pronounced effects on numerous physiological processes. Despite the toxicity associated with many members of this group, appropriate administration at relatively low doses may produce therapeutically valuable responses (1). Their broad spectrum of biological activities encompasses anti-inflammatory, anticancer, antibacterial, analgesic, muscle-relaxant, antioxidant, cardiotonic, antitumor, and narcotic effects (2,3). Owing to these pharmacological properties, several alkaloid-derived or alkaloid-based agents have been incorporated into clinical practice and are currently used as approved medicines (4,5). In addition to their therapeutic applications, some alkaloids can markedly influence central nervous system function, producing stimulant or depressant effects and, in certain cases, hallucinogenic responses (6).

Hallucinogenic alkaloids comprise a diverse group of psychoactive substances obtained from natural sources, particularly certain plants and fungi, as well as through chemical synthesis. Their effects primarily involve modifications in

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to prevent misuse and other undesirable situations. As the most accessible group of health care professionals, pharmacists have an important role to play in the prevention and treatment of substance use disorders. In this context, pharmacists are expected not only to monitor, assess and refer individual cases, but also to be active agents of change in addressing substance abuse in their communities. Pharmacists should receive continuing education to improve their knowledge and skills in this area and to keep abreast of innovative treatment modalities. Emerging research shows that the abuse of psychedelic drugs is not only pharmacological, but also a complex process involving long-term neurochemical changes. These developments require pharmacists to have a deeper understanding of pharmacological treatment options for substance abuse. Collaborative practice agreements and new federal guidelines for treatment management of drugs such as hallucinogenic alkaloids place greater responsibility on pharmacists. In this context, pharmacists must also comply with therapeutic regulations, taking into account the legal framework in which they are located. This is an area where it is critical not only to dispense substances safely, but also to act in accordance with the law. In summary, pharmacists should continue to educate themselves and keep abreast of developments in the field in order to comply with current legal requirements and ethical principles regarding psychedelics.

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