

♦ Editorial

Exploring medicinal plants as natural remedies through scientific investigation

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Abstract

The use of medicinal plants dates back to ancient civilizations, with records from Mesopotamia around 2600 BC and the Egyptians' "Ebers Papyrus" around 1550 BC detailing extensive plant-based remedies. The foundation of rational drug discovery began in the early 19th century, when Friedrich Sertürner isolated morphine from opium, prompting further exploration of bioactive compounds in plants. Many current medications, including codeine and aspirin, originate from these natural sources, demonstrating the economic potential of biodiversity through bioprospecting. Traditional healers often serve as primary healthcare providers, particularly in developing regions, where a significant portion of the population relies on traditional medicine. This holistic approach highlights the complex process of translating traditional medicines into modern therapies and underscores the importance of integrating traditional knowledge, phytochemistry, toxicology, and pharmacology. In recent years, a notable shift in public perception towards ancient healing practices such as Ayurveda and Unani has emerged, primarily driven by concerns over the side effects of synthetic drugs in modern medicine. This growing interest positions herbal remedies as essential components of healthcare, especially in developing countries. As more individuals look for natural options for health and wellness, there is a growing need for research that validates traditional herbal remedies. Medicinal plants are often considered to have fewer side effects than synthetic drugs; however, ensuring safety is crucial for herbal therapies. It is important to consider potential interactions between herbal remedies and prescribed medications, and new methods and technologies should be investigated. Future investigations should focus on establishing evidence-based practices by identifying bioactive compounds, elucidating mechanisms of action, exploring combination therapies, and conducting clinical trials. This evolution underscores a broader movement towards incorporating holistic health approaches into modern therapeutic frameworks, potentially reshaping the future of medicine and emphasizing a more integrated and sustainable healthcare model.

The earliest written records of medicinal plant use can be traced back to 2600 BC in Mesopotamia, where a sophisticated medicinal system was documented, featuring around 1,000 plant-based remedies. Egyptian medicine, dating to approximately 2900 BC, is represented by the “Ebers Papyrus,” which dates to around 1550 BC. This important document lists over 700 medications primarily derived from plants (Atanasov et al., 2015).

The origins of rational drug discovery from plants occurred in the early 19th century, when German apothecary assistant Friedrich Sertürner successfully isolated the analgesic and sleep-inducing compound from opium. He named the compound *morphium* (morphine) after Morpheus, the Greek god of dreams. Sertürner published a detailed paper on its isolation, crystallization, crystal structure, and pharmacological properties, initially studying it in stray dogs and subsequently through self-experiments (Sertürner, 1817). This sparked interest in the examination of other medicinal herbs, leading to the isolation of many bioactive natural compounds from their natural sources in the following decades.

Plants produce economically important organic compounds such as resins, oils, tannins, gums, rubber, dyes, waxes, flavors, fragrances, and pharmaceuticals. Many medicines currently in use, including codeine, aspirin, pilocarpine, pseudoephedrine, reserpine, quinine, scopolamine, vinblastine, and theophylline, have been derived from medicinal plants through ethnobotanical research programs (Eldeen et al., 2016). Another example, atorvastatin, commonly known as Lipitor, is the best-selling drug of the past 25 years. It is directly derived from a microbial natural product, with total sales in the USA from 1992 to 2017 amounting to \$94.67 billion (Newman and Cragg, 2020).

The growing recognition of plants’ therapeutic potential has led to the emergence of bioprospecting as a science-based approach to discovering new medicinal compounds. Bioprospecting refers to the search for, and sustainable use of, the chemical and genetic components of biodiversity and indigenous knowledge, which can create economic and social benefits for nations and regions. Many developing countries possess abundant medicinal plant resources used in traditional medicine. A significant portion of their populations rely heavily on traditional practitioners and medicinal plants to meet their primary healthcare needs (WHO, 2004). Traditional healing is a holistic approach to treating patients, making the translation of traditional medicines into modern therapeutic agents a complex process. In many cases, especially in rural areas, traditional healers are the first healthcare providers consulted and are deeply intertwined with cultural and spiritual life. Countries like South Africa are recognized as biodiversity hotspots, with over 24,000 plant species found within its borders, representing 10% of the world’s total, despite South Africa accounting for less than 1% of the Earth’s land surface (Abdalla and McGaw, 2018). It is estimated that at least 80% of Africa’s population consults Traditional Health Practitioners (THPs), with about 3,000 species used by roughly 200,000 indigenous THPs (Van Wyk and Prinsloo, 2018).

Together with bioprospecting, traditional knowledge, phytochemistry, and pharmacology are critical to the understanding of the efficacy of medicinal plants.

On one hand, indigenous communities have refined their knowledge of plant-based remedies over generations through experimentation, observation, and cultural inheritance, identifying plants and herbal concoctions that effectively address various health issues. This traditional knowledge provides invaluable insights into the therapeutic properties and proper applications of medicinal plants. Complementing this cultural wisdom, phytochemistry focuses on the chemical composition of plants,

allowing researchers to identify bioactive compounds responsible for their therapeutic effects. Compounds derived from medicinal plants are a significant focus in biomedical and natural product research, serving as vital sources of bioactive elements for drug development. Through analyses of the phytochemical profile of plant extracts, researchers can identify potential therapeutic agents and understand the mechanisms underlying their medicinal properties.

Building on phytochemical discoveries, pharmacology investigates how bioactive compounds interact with biological systems, clarifying the mechanisms of action of medicinal plants and validating their traditional uses. Through pharmacological studies, researchers evaluate the effects of medicinal plant extracts or isolated compounds on cellular processes, tissues, and organisms, contributing to the development of standardized herbal preparations and identifying potential drug candidates sourced from nature.

Although medicinal plants are often viewed as having lesser side effects compared to synthetic drugs, safety considerations are an essential part of dosage calculations and therefore, toxicology testing is an integral part of the scientific investigation of herbal therapies. Furthermore, the possibility of potential herb-drug interactions related to pharmacological and/or toxicological interactions between herbal remedies and prescribed synthetic drugs is also a key safety aspect. This represents an integrated multidisciplinary approach to scientifically investigate medicinal plants.

In recent decades, there has been a significant shift in how people view the modern medical system. Many individuals are increasingly interested in exploring ancient healing practices such as Ayurveda, Siddha, and Unani. This change is largely driven by concerns over the side effects associated with synthetic drugs used in modern medicine. As a result, herbal remedies are becoming increasingly vital and are seen as essential components of healthcare programs, particularly in developing countries. There are a number of opportunities offered by current approaches and methodologies for analyzing phytochemical profiles, as well as pharmacological and toxicological testing of herbal extracts. These methods include the use of animal models, cell cultures, various other models, for example nematode cultures, molecular docking in silico techniques, etc. Future research should focus on validating traditional herbal remedies for various diseases, identifying bioactive compounds, elucidating mechanisms of action, exploring combination therapies, and conducting various clinical trials to establish evidence-based practices for developing herbal treatments for specific conditions.

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