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*Editorial*

# PLANT EXTRACTS FOR DRUG DEVELOPMENT- IS IT ECONOMICAL?

**Binafsha Manzoor Syed**

**Medical Research Centre, Liaquat University of Medical and Health Sciences, Jamshoro, Pakistan**

**Correspondence:**
**Binafsha Manzoor Syed, Medical Research Centre, Liaquat University of Medical and Health Sciences, Jamshoro, Pakistan.**

**Email:**
Binafsha.syed@lumhs.edu.pk

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**ABSTRACT:**

Plants have been in use for medicinal purposes for centuries. A number of drugs have been developed from plant extracts and are currently in clinical practice. There are still a number of diseases where there is no specific treatment available such as dengue fever or only synthetic molecules are there with a number of side effects. Thus considering plants for development of new drugs would be a viable option, however it's a time consuming and rigorious process. However when compared to the synthetic molecules the initial cost incurred upon extraction and identification of the molecules from plant is much lower, the remaining clinical trial and quality control checks remain the same.

**Keywords:** Plant extracts, new drug development

## INTRODUCTION

In the global search for affordable and effective therapeutics, the pharmaceutical industry often returns to a paradoxical starting point: nature. Medicinal plants, used for millennia in traditional medicine systems, continue to serve as a rich source of bioactive compounds. From quinine to paclitaxel, history is full of examples where plant-derived molecules revolutionized clinical care. Yet in the high-stakes, high-cost arena of modern drug development, economic feasibility is paramount. The process of drug development from plant is complex and has to go through a number of processes and quality checks. So, the central question emerges: Are plant extracts a truly economical foundation for drug development in our current scenario?

### Historical background of drug development from plants

The economic case for plant-based drug discovery is bolstered by historical precedent. Natural products, particularly from plants, have contributed to over 50% of all new chemical entities (NCEs) approved between 1981 and 2019 for cancer, infections, cardiovascular conditions, and more. Notable examples include:

1. Paclitaxel (Taxol) from Taxus brevifolia, now a cornerstone of chemotherapy regimens.
2. Artemisinin, derived from Artemisia annua, for malaria treatment—recognized by a Nobel Prize.
3. Reserpine from Rauwolfia serpentina, one of the first antihypertensives.

These examples underscore a key point: plant-derived drugs can be both effective and economically viable, particularly when they address major global health burdens.

### Start-up point expenditure

The very first stage of the drug discovery from plant is the screening of the plant extracts, this stage tend to be less expensive as compared to de novo synthesis or combinatorial chemistry. Leveraging ethnopharmacological knowledge dramatically reduces the discovery timeline. Traditional knowledge can pre-screen thousands of species, guiding bioassays with cultural context and empirical evidence. Natural compounds often possess "privileged structures"—chemically unique scaffolds that bind effectively to biological targets. This "shortcut" reduces both time-to-hit and cost-to-hit, giving natural products a strong advantage in early discovery stages.

### Cost for further processes

The initial stage involves low cost, but further processes to evaluate if the plant driven molecule is consumable for human is a task involves a number of processes. Thus the economic burden of plant-derived drug development increases significantly in later stages. These stages include:

a. Standardization and Quality Control

Plant-derived compounds face intrinsic variability due to genetic polymorphisms within plant species, soil type, climate, altitude, and harvesting season. The differences in extraction solvents and techniques also affect the molecule. This variability impacts efficacy, safety, and reproducibility, making standardization a regulatory necessity and a cost center.

b. Extraction and Purification

Unlike synthetically designed molecules, plant extracts may contain hundreds of compounds. Isolating the active particle and ruling out synergistic or antagonistic interactions requires high-resolution analytical tools (which involves a real cost), repeated purification cycles and bioassay-guided fractionation. Each of these steps adds both technical complexity and financial cost.

c. Scale-Up and Sustainable Supply

The scalability of plant extraction is often unsustainable in its native form. For example, overharvesting of the Pacific yew led to significant ecological concerns during Taxol production. Sourcing artemisinin from Artemisia annua faced supply chain bottlenecks, prompting synthetic biology interventions. Cultivation, synthetic analogs, or biosynthesis are often needed to mitigate these constraints, but require upfront investment and technical infrastructure.

For low- and middle-income countries (LMICs), plant-based drug development holds unique promise. Many LMICs are biodiversity-rich and can benefit from value-added drug development pipelines. Local production of botanical medicines or derivatives could enhance health sovereignty and reduce import dependence. Traditional medicine systems (e.g., Ayurveda, Traditional Chinese Medicine, African traditional medicine) provide a treasure trove of leads—often underutilized due to lack of funding, infrastructure, or Intellectual Property (IP) protections.

International collaborations, such as those promoted by the World Health Organization (WHO) Traditional Medicine Strategy, aim to integrate traditional plant-based knowledge into evidence-based medical systems. Such models can balance economics, ethics, and access.

Plant-derived drugs can offer lower discovery and preclinical costs, but clinical and regulatory expenses are similar, making the overall economic viability dependent on downstream efficiencies and therapeutic value.

## CONCLUSION

In conclusion, plant extracts remain a promising and often economically viable starting point for drug development—but only when approached with strategic foresight, scientific rigor, and ethical responsibility. They can be cost-effective when integrated with modern tools. In addition, they can be fast-tracked with ethnobotanical guidance and biosynthetic solutions. The future of economical drug development lies not in choosing between natural and synthetic sources, but in harmonizing them. As biotechnology advances and global health priorities shift toward sustainability and accessibility, the value of plant-derived compounds is not only scientific—it is economic and ecological.