Medicinal Plants: Economic Perspective and Recent Developments

Haroon Khan and Abdur Rauf

Department of Pharmacy, Abdul Wali Khan University Mardan 23200, Pakistan
Institute of Chemical Sciences, University of Peshawar, K.P.K Peshawar-25120, Pakistan

Abstract: Medicinal plants are an integral part of our health care system. The therapeutic potential of plants and plant based product are recognized throughout the world. Globally, different systems of treatment exist such as Allopathic, Homeopathic, Ayurvedic, Chinese system of treatment etc. The developed communities have their own Materia Medica, compiling comprehensive information about various plants used for therapeutic purposes. The international herbal trade market is revolving around China and Indo-Pak while the total global herbal market of plant-based drugs has been estimated as $ 25-30 billion annually. The modern medical setup recognizing and moving to a system based on the combination of orthodox and natural therapies for the effective treatment of disorders.

Key words: Botanicals • Economic perspectives • Recent developments

INTRODUCTION

The history of medicinal plants is as old as Man himself. Medication history of plant in the form of traditional and folklore is based on the rich experiences of numerous healers, inherited from ancestors, or developed through personal experiences over time. Importantly, cultural revolutions have not distorted the in-depth wisdom of this natural medical treasure. Therefore, either current system of treatments can not ordinarily lay claim to it. The traditional system of treatment, differing in concept and protocol, exemplify well-developed systems such as Allopathic, Homeopathic, Ayurvedic, Chinese system of treatment [1-4]. The developed communities have their own Materia Medica, compiling comprehensive information about various plants used for therapeutic purposes. The merging of this human pharmacopoeia of natural origin with the incredible development in the various fields of modern medical sciences indeed provides the foundation for a much needed revolution in the existing healthcare system.

Over the earth planet, botanical review quantify the presence of approximately 250, 000 to 350, 000 plant species. However, only 35, 000 species are reported to be used for the treatment of various ailments in different parts of the world [5]. These plants are mostly exercised in unrefined or semi-processed form, often in mixtures; therefore require quality control testing and rigorous clinical trials for scientific rationale [6-7]. Researchers believed that approximately 15% of medicinal plants have been subjected to phytochemical analysis and 6% to biological screening [8-10]. The rest of plants remained untouched; therefore, this therapeutic modality has tremendous scope in the discovery of new effective therapeutic agents.

Economic Perspectives: On the face of global acceptance in all ages, phytopharmaceuticals are portrayed as cornerstone in the world trade and economics (Table 1). The total global herbal market of plant-based drugs has been estimated as $18 billion in 2005 [11-12]. Obviously, the international herbal trade market is revolving around China and India. The annual herbal drugs export of China is estimated over 120,000 tonnes followed by India with approximately 32,000 tones. In contrast, Europe is the primary importer of remedial plants and around 400,000 tonnes are imported each year by different European countries to meet the local demand of herbal formulations [6, 13-14].

The report in the British parliament expressed the strong faith of English community in natural remedies. British spent 126 million £ in 2002 while visit to the clinics

Corresponding Author: Haroon Khan, Department of Pharmacy, Abdul Wali Khan University Mardan 23200, Pakistan.
Recent Development in Phytomedicine: Medicinal plants have played an amazing role in the development of new clinically effective drugs (Fig. 1). Though remarkable development has been made in the fields of chemistry such as synthetic, combinatorial and biotechnological sciences, medicinal plants can still be exploited as an initial point for the synthesis of new compounds with different structural parameters. In the presence of these sophisticated technologies, the plant-derived drugs become more streamlined. The proper utilization of these techniques has already led to the discovery of some interesting clinically useful molecules [19-21]. Importantly, 15 compounds of natural origin have been launched during 2000-2003 while the same number of compounds are in the phase II clinical trials or registration stage of drug development [22]. It has been recently estimated that the natural product offer 100 times higher hit rate when compared with synthetic drugs [23-24].

The perfect coordination of numerous fields is crucial in the discovery of phytomedicine. The identification and collection of plant material from specific locality is the job of ethnobotanist [25]. Phytochemist urges to design rapid but efficient method of extraction from plant source. Keeping in view the fork uses, the ethnopharmacologist proposes and screens out the extract in some relevant assay. Based on the fallout of test, the phytochemist subjects the extract to the isolation of pure chemical entities that could be responsible for the activity. Afterward, different clinical trials are carried for the particular molecule. It is bitter truth that only one molecule out of 5000 successfully completes all stages of development and obtain registration for clinical applications [19].

Future Challenges to Phytomedicine: Several challenges are ahead of drugs discovery from medicinal plants. The various components of the team like ethnobotanist, ethnochemist and ethnopharmacologist needs to further
strengthen coordination in order to get more fruitful results in terms of effective therapeutic agents for the treatment of many challenging human disorders [17, 26]. The plant-based scientist has to work out and expedite various techniques involved in the drug discovery [25]. It has been observed that drug discovery passing through different stages of development takes approximately 10 years and with overall expenditure of $800 million. However, the plant based drugs discovery usually needs more time and complex events as compared to other modes of drug discovery. This has created a negative impact on the fate of various ongoing projects and as a result, the pharmaceutical companies withdrew many research projects on medicinal plants [22].

Since natural compounds are highly value added products, it is therefore extremely important to induct new modern techniques in the method of collection and other processes involved in the product development in order to prevent irrelevant wastage of time and expenditures. For instance, paclitaxel was isolated from *Taxus brevifolia* with prominent anticancer properties. Despite of structural conformation and established therapeutic activity, the compound took almost 20 years in marketing approval as Taxol [27]. However, the introduction of new technologies like high-throughput enormously expedites screening of extracts; 100,000 plant extracts can be screened in a period of 1 week while using a 384-well format. The commendable development in spectroscopy and chromatography in addition to the use of cell culture techniques for considerable increase in percentage yield of desirable components of plants, can revolutionize the plant base new drugs [28].

**Quality Control of Phytomedicine:** The advocates of medicinal plants have the opinion that they are always safe because of natural origin. But the inherent safety claims about medicinal plants always appeared controversial. Nevertheless, this principle of safety is absolutely ruled out by the clinical findings on the heavy metals poisoning from different parts of the world [29-31]. Of particular importance is not only the intrinsic plants toxicity but also adulterations, provoking multiorgan toxicity [32]. As a result, the Food and Drug Administration (FDA) has pointed out some of the commonly used botanicals for lethal unwanted effects [33]. Consistency in composition is primarily important for the efficacy and safety of phytomedicine that also related to the overall therapeutic response. Since botanicals are the mixture of different/numerous biological active components, their standardization could rarely be possible because of multiple known reasons [33]. However, different models for the standardization of phytomedicine is available that need further polishing [34].

The legislative bodies are urging to play their role in the quality control of herbal formulations. Under the umbrella of WHO, a recent comprehensive survey report revealed that many countries have established or near to establish national regulatory guidelines for the safe use of herbal remedies [35]. The longstanding traditional experience as an evidence of botanical safety is not always logical and acceptable to detect their rare or late outcomes (Fig. 2). The dearth of scientific studies on botanicals is rightly criticized by the advocates of orthodox medicines. Particularly to determine the therapeutic value of any drug, the randomized, controlled trials are frequently suggested. The product safety evidence should be mandatory for any botanicals like orthodox synthetic drug in order to prevent the end users from the unwanted effects of these formulations. That is why the new issued guidelines of the Food and Drug Administration permit the approval of herbal mixtures with

![Fig. 1: Drugs derived from plants in different stages of clinical trials [39]](image)
Fig. 2: Flow chart showing toxicity due to herbal products [32]

the evidence of safety and efficacy, even though the active constituents are not identified [36]. Indeed to guarantee the fruitful outcomes from medicinal plants, scientific inquiry is indispensable in the light of modern sophisticate technologies [37].

To sum up, the plant base drugs have unmatched chemical diversity and an incredible potential of novelty with different mechanistic templates. Simply, nature has incorporated best combinatorial chemistry in plants. Various research laboratories are currently involved in phyto-medicines research with some outstanding success over the years. Consequently, several promising new chemical entities of plant origin are in clinical trial phase. However, many folds are still most wanted to explore unseen secrets of their curative potentials and to relieve humanity from dreaded diseases. Indeed the surging waves of pragmatism based on the experimental findings in various research laboratories addressed the healthcare professionals. Ultimately, the modern medical setup recognizing and moving to a system based on the combination of orthodox and natural therapies as a leading science to deal with the wisdom that lies in botanicals. The merging of this natural human pharmacopoeia with the incredible development in the various fields of modern medical sciences indeed provides the foundation for a much needed revolution in the existing healthcare system.

REFERENCES


