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Traditional Herbal Medicine and Its Clinical Relevance: A Need to Preserve the Past for the Future

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Abstract

Herbal medicines have been gaining popularity worldwide. They are an integral component of alternative medical care and provide a rich source for innovative drug discovery. However, the rapid increase in the demand for herbal medicines and products has led to the rapid depletion of herbal plants. In addition, rapid population growth, industrialization, and global climate change have endangered these medicinal plants. Given the imminent threat associated with the loss of medicinal plant diversity, this review highlights the need to protect these threatened plant species and avoid the loss of their therapeutic value. The aim of the study was to conserve resources and link them with current research activities and projects to develop novel and more effective drugs in the future.

Keywords

Herbal Medicines, Traditional Medicines, Conservation, Biodiversity, Alternative Therapy

1. Introduction

For thousands of years, herbs have been used as traditional medicines in Eastern countries [1]. In these countries, knowledge on certain minerals, animals, and

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herbs with healing properties, resulting from hundreds of years of bold experimentation through trial and error, has been passed from generation to generation [2]. The use of such natural products is of great importance in Ayurveda, Kampo, Siddha, Traditional Korean Medicine (TKM), Traditional Chinese Medicine (TCM), Unani, and others [3]. Some of these products are incorporated into modern medicine and have gradually entered the Western medical market as complementary and alternative therapies [4].

Nature is a source of new medicines to alleviate suffering and cure various diseases. According to the WHO, almost 80% of the global population relies on herbal species for health care needs [5]. Interestingly, 122 medicinal compounds have been isolated from 94 plant species [6]. These compounds include papaverine, isolated from *Papaver somniferum*, which is used to synthesize verapamil (an antihypertensive drug), and galegine, isolated from *Galega officinalis* L., which is used in the synthesis of the antidiabetic drug metformin [7]. Metformin, initially considered a sensitizer, acts by enhancing the action of insulin on hepatocytes, myocytes, and adipocytes. Recent studies suggest its beneficial influence on the myocardium, Beta islets of the pancreas, and intestinal epithelium functioning [8] [9] [10]. Other medicinal drugs developed from herbal sources include digoxin, amiodarone, aspirin, reserpine, atropine, and tetrandrine [11].

At present, hospitals in China prescribe various herbal medicines to thousands of patients daily [12]. Each year, TCM is used to treat over 200 million patients in China, accounting for approximately 40% of all healthcare deliveries [13]. Similarly, nearly 70% of allopathic doctors prescribe traditional medicines to their patients in Japan [14]. Likewise, almost 70% of Koreans have used TKM [15]. In Malaysia, the market demand for herbal medicines ranges from 40 to 100 billion USD, with an average annual growth of approximately 20% [16]. Even in the West, there has been tremendous growth in the use of herbal products [17]. In 2015, Rashrash *et al.* [18] conducted a national survey in the United States and reported that approximately 35% of adult Americans use herbal supplements regularly. According to a report published by Hexa Research [19], the global herbal medicine market was worth USD 71.19 billion in 2016. As per World Health Organization (WHO), the global market value of herbal products is expected to grow to USD 5 trillion by 2050 [20].

Unfortunately, with the increased global utilization of herbs and herbal products, many plant species are already on the brink of extinction [21]. The overexploitation of such medicinal plants threatens their survival. The conservation and protection of such plants are essential to ensure the future supply of beneficial herbal compounds and secure livelihoods [22]. Indeed, these herbal compounds and their derivatives offer a natural and accessible opportunity for novel drug development. Therefore, we aimed to highlight knowledge of traditional medicine to broaden its portrayal and emphasize the conservation of such natural resources. More effective management of these resources is needed to meet future demands and help clinicians and researchers combat the occurrence of

illnesses, diseases, and health conditions.

2. Traditional Medicine Systems

2.1. Chinese Herbal Medicines (CHM)

Chinese herbal medicines include ethnic herbal and folk medicines [23]. CHM comprises more than 11,000 medicinal plants, approximately 1500 animal/animal parts and insects, 80 mineral medications, 50 processed remedies, and 5000 clinically approved herbal formulas [24] [25] [26]. Each herbal prescription is a blend of multiple herbs tailored to an individual patient. Due to differences in climatic and geographical conditions, inhabitants of various areas in China have unique cultures, customs, lifestyles, and disease spectrums [27]. These changes have led to the emergence of a vast variety of traditional medical practices. There are 56 ethnic groups in China, with 56 different languages, cultures, and herbal medicines [28]. Each year, China exports more than 7000 types of medicinal and related herbal products to more than 130 countries worldwide, including cloves, pinellia, angelica, tianma, fritillaria, eucommia, licorice, turmeric, frankincense, rhubarb, wolfberry, berberine and panax [29] [30]. The export value of China's herbal medicines is USD 1.567 billion [31].

2.2. Indian Herbal Medicine (IHM)

India is home to around 126,000 species and is estimated to comprise nearly 8% of the world's biodiversity; among 400 families of flowering plants, 315 can be found in India [32]. Almost 20% of the global species (approximately 45,000 species) are found in the Indian subcontinent; and approximately 3500 plants have medicinal significance, of which nearly 500 medicinal plants are used in the Ayurvedic industry [33]. Roughly 80% of medicinal plants are collected from the wild [34]. Among herbal products exported by India, 10% are Ayurvedic preparations, 30% are crude herbal extracts, and 60% are processed herbal extracts [35]. Some major pharmaceuticals derived from plant materials exported by India include menthol, Mehdi leaves, isabgol, sandalwood oil, cinchona alkaloids, jasmine oil, agarwood oil, and opium alkaloids [36].

2.3. Arabic Herbal Medicine (AHM)

Among the 2600 species of plants in the Middle East, more than 700 are known for their medicinal properties or use as botanical insecticides [37]. However, only 200 - 250 herbs are still used for the treatment of various diseases, in addition to 29 inorganic substances and 30 animal species [38]. From the Mediterranean coast, Alexandria to Egypt, 230 herbal species have been identified from 48 families. Among these species, 89% are known for their medicinal properties [39]. In Israel, 129 medicinal plants are used to treat various medical complications, including skin diseases, respiratory diseases, digestive tract diseases, high cholesterol, obesity, and multiple types of cancers [40]. However, most herbalists (such as those in Jordan) do not receive proper training in herbal medicine.

3. Drugs Developed from Natural Resources

Traditional medicine is an inseparable part of modern drug discovery. By obtaining a large amount of data from clinical trials, traditional medicine assists in the development of drug compounds. Literature shows that traditional medicines derived from plant extracts are more clinically effective and affordable, with fewer side effects than modern medicines [41] [42]. Researchers from clinical laboratories have published numerous examples of potent and highly effective modern drug compounds based on traditional medicines. Among these drug compounds, artemisinin, isolated from *Artemisia annua* L., has been known to exhibit anti-malarial and anti-cancerous properties [43] [44] and is known to save millions of lives every year. In 2015, Professor Youyou Tu was awarded the Nobel Prize in Physiology or Medicine for her significant devotion in discovering artemisinin [45].

Among synthetic drugs, bifendate and its derivative bicyclol are anti-hepatitis drugs discovered while researching the herbal plant *Schisandrae chinensis* [46] [47]. Similarly, many highly effective pain relievers are derived from the analgesic compound morphine, isolated from *Papaver somniferum* [48]. Colchicine, isolated from *Colchicum autumnale*, is a well-known antitumor agent used to treat arthritis [49]. Various analogs of camptothecin (isolated from *Camptotheca acuminate*), such as topotecan and irinotecan, are used to treat gastric, bladder, colon, and rectal cancers [50]. Paclitaxel (Taxol), a drug isolated from *Taxus brevifola*, is used to treat various forms of cancer [51]. Similarly, vinblastine and vincristine, extracted from the leaves of *Catharanthus roseus* L., are among the essential anticancer drugs used to treat leukemia and testicular and bladder cancers [52]. *C. roseus* is the most crucial anticancer-agent-producing plant globally [53]. Some examples of other drug compounds isolated from plant sources and their therapeutic significance in clinical practice are summarized in **Table 1**.

Table 1. Therapeutic effects and uses of some drugs or compounds developed from herbal sources.

Plant origin	Drugs or compounds	Therapeutic effects and uses	Reference
Corydalis yanhusuo	Tetrahydropalmatine	Analgesic	[54]
Rhizoma Chuanxiong	Tetramethyl-pyrazine	Myocardial ischemia-reperfusion injury	[55]
Paeonia lactiflora	Paeoniflorin	Analgesic and sedative	[56]
Epimedium brevicornum	Icariin	Cancer and osteoporosis	[57]
Pueraria lobata	Puerarin	Diabetes and osteonecrosis	[58]
Salvia miltiorrhiza	Salvianolic acid B	Cardiovascular diseases	[59]
Uncaria rhynchophylla	Rhynchophylline	Anti-inflammatory, neuro-protective and anti-hypertensive	[60] [61]
Saussurea lappa	Costunolide	Anti-tumor	[62]
Gastrodia elata	Gastrodin	Neuro-protection and anti-convulsion	[63] [64]

4. Threatened Herbal Species and Their Conservation

Traditional herbal medicines rely on standardized extracts from herbal plants. However, the over-exploitation of herbal resources in an unscientific way and their poor natural regeneration has led to the near extinction of some important herbal plant species [65]. This poses a serious threat to biodiversity and ecological networks, resulting in the genetic erosion of species-rich regions [66]. In the scientific community, the extraction of biologically active compounds from medicinal plants and evaluation of their therapeutic properties have been largely studied [67] [68]; however, the sustainable management of such resources has received little attention [69]. According to the International Union for Conservation of Nature and the World Wildlife Fund, 50,000 - 80,000 species of flowering plants are used globally for medicinal purposes. Among these species, approximately 15,000 are threatened by extinction, and 20% of these species have already been depleted [70]. In 2012, the *Red Data Book of India* was released which highlighted more than 10,000 herbal species as "vulnerable", 5,766 species as "endangered", and 3947 species as "critically endangered" [25]. Species are more susceptible to decline than others when reproductive organs (fruit, flower seeds) or vegetative organs (root, rhizome) are used [71]. This accelerated decline in species has led to an increased risk of extinction of medicinal plants, particularly in Nepal, India, Uganda, Tanzania, Kenya, and China [72]. Apart from over-exploitation, global warming and climate change has resulted in the extinction of plant species on a broad scale. Other potential causes of this loss include heavy livestock grazing, habitat alteration, habitat specificity, genetic drift, and human population explosion [73].

Considering the significance of medicinal plants in human health and well-being, there is a crucial need for their conservation. Literature provides various conservation strategies for the sustainable use of medicinal plants. *In situ* and *ex situ* conservation are considered two distinct methods for the protection of herbal species [74]. The *in situ* or on-site conservation methodology involves the preservation of entire biodiversity-rich habitats in a pristine and pure manner [75]. In many countries, initiatives have been undertaken to establish natural ecosystems, including biosphere reserves, recreational forests, national parks, wildlife sanctuaries, and other types of protected areas [76]. *Ex situ* conservation methods include botanical gardens, field gene banks, seed banks, and pollen storage [77]. Biotechnological approaches for the conservation of herbal species include micrografting, micropropagation, cryopreservation, protoplast culture techniques, somatic embryogenesis, organogenesis, and synthetic seed technology [78] [79]. In this scenario, local governments should develop concrete plans to ensure the ethical exploitation of herbal resources in their country and promote scientific methods to collect and regenerate medicinal plants [80]. Governments are encouraged to promote good agricultural practices (GAP) for these plants to ensure the quality and standardization of herbal medicines [81].

5. Conclusion

Traditional herbal medicines are considered to be significant healthcare providers worldwide. Owing to their efficacy, safety, and fewer side effects, these medicines are in great demand across all healthcare issues in developed countries. Most current conventional drugs are chemically synthesized, and some are isolated from medicinal plants for therapeutic use. Various herbal medicines have evolved based on culture and geographic region, and their market has grown substantially in recent years. However, rapid population growth, industrialization, global climate change, over-exploitation, and unscientific use of medicinal plants have led to their endangerment. Many of these precious medicinal plants are currently on the verge of extinction. Therefore, it is crucial to protect plant biodiversity for the sustainable production of plant-derived compounds. Considerable attention needs to be paid to the compilation and documentation of available traditional knowledge of medicinal plant resources. In addition to conserving existing plant resources and quality control of herbal medicines, a detailed biological, phytochemical, and pharmacological investigation of therapeutic herbal compounds is essential for future drug development.

Conflicts of Interest

The authors declare no conflict of interests.

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