



A Review of Significance of Herbal Medicine and its Evolution as a Therapeutics in Global Healthcare

Abdullah Al Mamun ^{1*}, Md Shamsuddin Sultan Khan ²

Abstract

There has been a renewed interest in herbs and their formulations in recent years, driven by the growing demand for natural healthcare and the diverse health benefits these plants offer. This article shows herbal formulation, exploring its development activities, processes, challenges, and opportunities. Herbal products are created by extracting and preparing active compounds from medicinal plants, and incorporating them into various forms like capsules, tablets, creams, or tinctures. This enhances the bioavailability, stability, and safety of herbal ingredients. Developing effective herbal formulations requires a deep understanding of plant phytochemistry, pharmacological properties, and their interactions with other ingredients. The journey begins with carefully selecting botanical specimens, followed by rigorous extraction and purification processes. Quality control standards are strictly maintained, utilizing advanced analytical techniques such as chromatography and spectroscopy. Despite challenges like environmental factors and regulatory complexities, the herbal sector thrives globally due to the rising demand for natural healthcare. Exploring new herbal formulations, like adaptogens and nutraceuticals, combines ancient wisdom

with modern scientific advancements. Approximately 85% of clinical trials involving herbal products show positive outcomes, emphasizing their effectiveness. In conclusion, the symbiotic relationship between tradition and progress in herbal formulation plays a crucial role in meeting the increasing demand for sustainable healthcare. It not only preserves traditional knowledge but also taps into the therapeutic potential of medicinal plants in the modern healthcare environment. The herbal formulation market reached \$83 billion globally in 2021, highlighting its significant growth.

Keywords: Herbal Remedies, Regional Ailments, Traditional Medicine, Scientific Validation

Introduction

The first decade of the 21st century has seen significant improvements in human well-being, but alongside this progress, many parts of the world continue to face great destitution. Healthcare accessibility, cost, and disparities have increased globally. Recognizing access to quality healthcare as a human right has been a focus for international organizations for a century. Key players include the United Nations Human Rights Commission, the World Health Organization (WHO), and the Millennium Development Goals (MDGs).

In both industrialized and developing nations, there is a growing interest in Traditional Medicine/Complementary and Alternative Medicine (TCAM) and its significance to public health. Traditional medicine's adaptability, accessibility, acceptability in developing

Significance | This review provides the history of herbal medicine and its impact in modern healthcare evolution

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nations, and rising popularity in industrialized nations contribute to its appeal. Factors such as low cost, minimal side effects, and economic expansion further enhance its importance, as described by WHO in 2002.

Despite these advantages, integrating traditional medicine into public healthcare is crucial to enhance healthcare access. However, evidence suggests a discrepancy in public decisions regarding integrating various medical systems. The World Health Organization (WHO) identifies safety, effectiveness, quality, and reasonable use of traditional medicine as key policy challenges.

According to the World Health Organization (2002), traditional medicine encompasses health practices, knowledge, and beliefs involving plant, animal, and mineral-based medicines, spiritual therapies, manual techniques, and exercises. It is applied either individually or in combination to treat, diagnose, prevent illnesses, or maintain well-being. The terms "complementary medicine" and "alternative medicine" describe medical procedures not integrated into a country's primary medical system, reflecting diverse classifications of herbs.

Various terms like alternative medicine, complementary medicine, natural medicine, herbal medicine, phytomedicine, non-conventional medicine, indigenous medicine, folk medicine, and ethno-medicine vary based on the context or form of knowledge. Homeopathy, acupuncture, chiropractic, osteopathy, Siddha, Unani, Kampo, Jamu, Thai, Chinese medicine, Ayurveda, herbal medicine, bone-setting, and spiritual treatments are enduring systems within this spectrum. Various schemes categorize Traditional medicine differently, with no cohesive medical knowledge and practice (Van der Geest 1997; Patwardhan 2005).

The WHO strategy (2002) notes that the term "alternative" in the context of herbs is defined more by what they are not than what they are. Traditional diagnosis often leads to unique and complex treatments, with traditional Chinese medicine remaining prevalent. More than half of the population consistently uses traditional medicine, especially in remote regions. In China, where there are over 5000 traditional medicines, they contribute to one-fifth of pharmaceutical sales (Saito, H. et al, 2000).

In resource-limited areas, traditional medicine remains the most accessible and affordable form of therapy. The local population has a rich history of using medicinal plants for therapeutic purposes. The Chinese pioneered natural herbal concoctions as medicines, dating back to 4000-5000 B.C. The Rig-Veda, believed to be from India (1600-3500 B.C.), contains early references to plant-based medicine.

Ancient physicians in India, forming an indigenous school of medicine, extensively studied and documented the characteristics and therapeutic applications of medicinal plants, laying the foundation for ancient medical knowledge (Prakash & Gupta, 2005). Worldwide, traditional medical systems heavily rely on

medicinal plants, providing a valuable source for research and development of natural drugs through ethnobotany (Farnsworth et al. 1990).

The term "traditional" implies extensive historical use, evident in items marketed as "traditional herbal medicines." In many developing nations, a significant portion of the population relies on traditional healers and their medicinal plant arsenal for health maintenance and medical needs.

Since the middle Paleolithic period, the earliest humans have used plants as medicine, as evidenced by fossil records. A 60,000-year-old Neanderthal man's burial revealed several plants, identified through pollen analysis, with medical potential. The oldest medical record, a clay tablet from Sumeria dating back 4,000 years, documents botanical treatments for various ailments.

In ancient Egyptian civilization, therapeutic plant knowledge was already well-established. Mandrake was suggested for pain relief, while garlic was recommended for circulation and cardiac conditions. Around 3500 years ago, the preservation of this knowledge included a papyrus with thousands of other cures. The early medical use of plants is also evident in ancient China (Li, L. et al, 2000).

Even though modern medicine coexists with traditional practices, herbal remedies are often used for historical and cultural reasons (Vishwakarma et al., 2013). Natural products worldwide, including terrestrial plants, microbes, marine species, vertebrates, and invertebrates, play a crucial role in treating and preventing human ailments (Newman et al, 2000). The value of these products in contemporary medicine has been discussed in various reviews and reports (Jones et al, 2006).

Factors determining the value of natural products include the introduction rate of new chemical entities, the diseases treated or prevented, and their frequency of use in treatment. Traditional medicine has seen less popularity recently, but there is growing interest in plant research information (Newman et al, 2007). The increased interest in natural product chemistry is driven by unmet treatment needs, the diversity of chemical structures, and biological activities of natural metabolites.

The World Health Organization (WHO) recognizes the value of traditional medicine and has developed policies, guidelines, and standards for botanical medicines (WHO, 1993). Herbal medicines, novel therapeutics, and many contemporary medications are indirectly derived from plants, with around 250,000 different types of flowering plants estimated. Understanding plant toxicity and therapeutic aspects ensures the safe use of medicinal plants like *Thymus vulgaris* as bioactive natural substances in both conventional and modern medicine (Hossain et al., 2020).

Present Status of Herbal Medicine

In France and Germany, 70% of medical practitioners frequently prescribe herbal medication, indicating that herbal medicine is not limited to underdeveloped nations (Alschuler et al, 1997). Patients increasingly opt for herbal therapies (Alschuler et al, 1997). The US Food & Drug Administration (FDA) has eased regulations on selling herbal dietary supplements (Brevoort P. 1998), leading to an expanding market for herbal products (Brevoort et al, 1998).

Data shows that the European Union had a \$6 billion herbal medicine industry in 1991, with Germany accounting for \$3 billion, France for \$1.6 billion (possibly over \$20 billion), and Italy for \$0.6 billion. In the US, around \$4 billion worth of herbal medicines were sold in 1996; since then, the market has doubled.

Rauwolfia serpentina, also known as Indian snakeroot, contains the key element reserpine. Initially used in the 1950s to treat specific emotional and mental issues, reserpine played a significant role in the therapy for mental diseases, though it is less commonly used for this purpose today. Reserpine is a main component in some contemporary treatments for high blood pressure but may have a side effect of causing severe depression (Dwyer et al, 1993). In India, *R. Serpentina* tea has been utilized for thousands of years as a sedative (Dwyer et al, 1993).

The history of medicine and pharmacy reveals a pattern where people initially used environmental resources empirically for treating illnesses. Fragments of plants, animals, and bacteria were used in their natural state as concentrated extracts to enhance potency and consistency. Pure chemical substances were later used as prototypes for creating synthetic chemical entities with higher activity levels (Robbers et al., 1996). Plant materials continue to be the basis for the majority of drugs used today, addressing various conditions such as cardiac problems, irritable bowel syndrome, cancer, asthma, neurological conditions, hypertension, depression, and pain disorders.

Natural product research has seen a resurgence with identifying novel compounds from marine creatures (e.g., bryostatin) and effective chemotherapy medicines from plants (e.g., Taxol). The development of rapid-throughput bioassays, utilizing robotic arms and computer-controlled cameras, has advanced research. However, the imminent extinction of 12.5% of all plant species poses a threat, with the estimate from the International Union for the Conservation of Nature (IUCN) considered conservative by most botanists (Cox et al. 2000).

The popularity of herbal remedies has increased, driven by the desire to tap into ancient healing systems (Tyler et al, 1999). Especially in Europe and North America, herbal items are included in alternative, complementary, holistic, or integrative medical practices. Organizations like the World Health Organization (WHO, 1999), German Commission E (Blumenthal et al, 1998), and the European Scientific Cooperative on Phytotherapy (ESCOP, 1999) have monographs on certain plants. WHO monographs

provide characteristics of herbs, including synonyms, popular names, geographical range, identification methods, purity, active ingredients, dose, dosing, and examination methods.

Traditional therapeutic approaches, like herbal medicines, gained significant popularity in the latter half of the 20th century, driven by a growing interest in self-care, especially in the USA (Fumonisin et al, 2002). Natural plant-based products with proven biological qualities, such as antioxidants, antiseptics, diuretics, and sedatives, are available in the European market. Some of these plants, used in traditional medicine since antiquity, are sold as extracts, pills, or infusions. Customers favor these items for their perceived high quality, considering them safer than synthetic medications. They are viewed as part of a healthy lifestyle, helping avoid unnecessary exposure to traditional Western medicine (Schulz et al., 2001).

Modern and Traditional Prescription of Herbal Drugs

Herbal medicine has a long history of pharmacological use for treating sickness. While the popularity of herbalists declined in the eighteenth and nineteenth centuries, many of their recommended treatments were effective. The medical world saw a shift as professionals experimented with therapeutic chemicals, turning some into helpful prescriptions. William Withering was the first to scientifically examine a folk treatment, conducting foxglove research (1775–1785) for dropsy (congestive heart failure), setting a standard for medicinal research.

In the nineteenth century, scientists began isolating active compounds from therapeutic plants. In 1806, Friedrich made a significant contribution to medicinal chemistry by isolating morphine from the opium plant (*Papaver somniferum*). This development led to the rise of German scientist Justus von Liebig as a pioneer in the development of pharmacology.

In the mid-nineteenth century, the first entirely synthetic medications based on natural items were created, as a better understanding of active chemical components emerged (Schulz et al, 2001). Many of these substances, including alkaloids, steroids, tannins, phenol compounds, and flavonoids, are considered bioactive and have clear physiological effects on the body (Donald et al., 2000). Medicinal plants contain therapeutically significant secondary metabolites and essential oils, offering affordability, efficiency, availability, and safety in treating various illnesses.

One category of secondary metabolites, phenol compounds, functions as antioxidants and is diverse across plant species (Cronquist et al, 1988). *Thymus* species, particularly *T. vulgaris*, are widely cultivated for herbal remedies, especially in rural regions, addressing various issues like inflammation, rheumatism, muscular aches, insect bites, swelling, and more (Namsa et al, 2009). Over the past decade, pharmacological studies have highlighted specific functions of thyme essential oil and plant extracts, showing antibacterial, anti-tissue, antispasmodic, and antimicrobial actions

(Marculescu et al., 2007). Thyme is used in medicine, culinary, and fragrance sectors, serving as a preservative due to its antioxidant and being a base ingredient in perfumes and cosmetics.

Integrating traditional medicine with the conventional health sector has various perspectives. A utilitarian view suggests validating and incorporating TCAM knowledge to enhance contemporary medical knowledge, citing examples like Artemisia for malaria and salicylic acid for fever. A syncretic approach aims to merge aspects of both systems to create a new one. Complementarity, a popular approach, involves TCAM supporting the health system, as seen in developed countries. The co-evolution perspective suggests that different forms of knowledge evolve simultaneously, partly in response to their interaction with others. A trans-cultural and transdisciplinary synergy approach advocates acknowledging that sciences represent one type of knowledge among others, benefiting from comprehensive interaction.

There's also a romantic view supporting the preservation of TCAM as it is considered 'good.' On the contrary, some see TCAM as marginalized by conventional medicine in a hierarchical health system. A paternalistic view suggests continuous updating of TCAM through scientific studies (Haverkort, 2006).

The use of herbal medicines is growing worldwide, available in drug stores and grocery stores. Pharmacists engage with herbal products by extending their established role in pharmaceutical care and clinical practices. Encouraging patients to share information about herbal medicines with primary care providers or allowing pharmacists to inform providers is crucial for comprehensive care (Haverkort, 2006).

Processes Involved in the Preparation of Herbal Formulation

The economic value of herbal products in international trade and commerce is recognized, leading to various regulations on their use. Concerns about factors like crude material quality, herbal source variability, inherent toxicity, and processing and manufacturing are raised. To ensure the safety, quality, and effectiveness of herbal products, it's essential to identify source plant species and understand the collecting part in their preparation. Post-harvest procedures are crucial for herbal processing, involving raw herbs or herbal material to enhance safety and efficiency, maximizing therapeutic activity and quality in finished herbal products. To maintain standards, Good Herbal Processing Practice (GHPP) and Good Agricultural and Collection Practices (GACP) provide processing method series for herbal medicine production and manufacturing (Figure 1). The processing of herbal materials includes primary and secondary processing, but it varies from herb to herb (WHO, 2017).

Primary processing involves washing, size reduction, cleaning, garbling, parboiling, drying, and garbling. Additionally, many herbal materials require "specific processing" directly related to

decocting material for the therapeutic activity or starting material for finished herbal products, including cutting, sectioning, comminution, roasting, boiling, sweating/aging or steaming, stir-frying, and fumigation. Secondary processing ensures the purity of raw herbs, improving their therapeutic profile by reducing toxicity or enhancing clinical efficacy (GACP, 2003). For instance, boiling or steaming Aconite root before consumption is a secondary process to reduce toxic compounds.

Herbal materials encompass herbs, crude botanical ingredients, gums, exudate, and balsams. "Herbal preparation" is produced by subjecting botanical ingredients to various processes like extraction, fractionation, purification, concentration, fermentation, and others. These preparations can include fragmented or powdered herbal material, extracts, tinctures, essential oils, decoctions, expressed plant juices, cold and hot infusions, and more. Herbal material can serve as a starting material, and herbal preparation can be considered an intermediate material for manufacturing finished herbal products or dosage forms for therapeutic use. Finished herbal products consist of one or more herbal preparations formulated from one or more herbs, and products composed of various plant materials are known as "mixture herbal products" (WHO, 2017).

Standardization of Herbal Formulations

Herbal remedies are widely available "over the counter," and many people use them without knowing their safety, quality, purity, or clinical effectiveness. To ensure the safe distribution of herbal supplements and products, they must undergo standardization and quality control before entering the market. The standards and techniques for regulating the quality of finished herbal products, especially those with a combination of herbs, are more complex than those for synthetic or chemical medicines (WHO, 2017). This complexity arises because the quality of finished products depends on the quality of the raw herbal material used.

To address these concerns, the World Health Organization (WHO) has developed four documents providing technical guidance in critical areas for quality control in herbal medicine production. These documents include WHO guidelines on good agricultural and collection practices (GACP) for medicinal plants (GACP, 2003), WHO guidelines on assessing the quality of herbal medicines concerning contaminants and residues, Good processing practices for herbal materials (in preparation), and Analytical methods for chemical identification of ingredients/constituents for quality control of herbal medicines (WHO, 2017).

Treatment of various health ailments with herbal medicine

Herbal remedies have been utilized for various health issues, including:

Anti-cancer properties

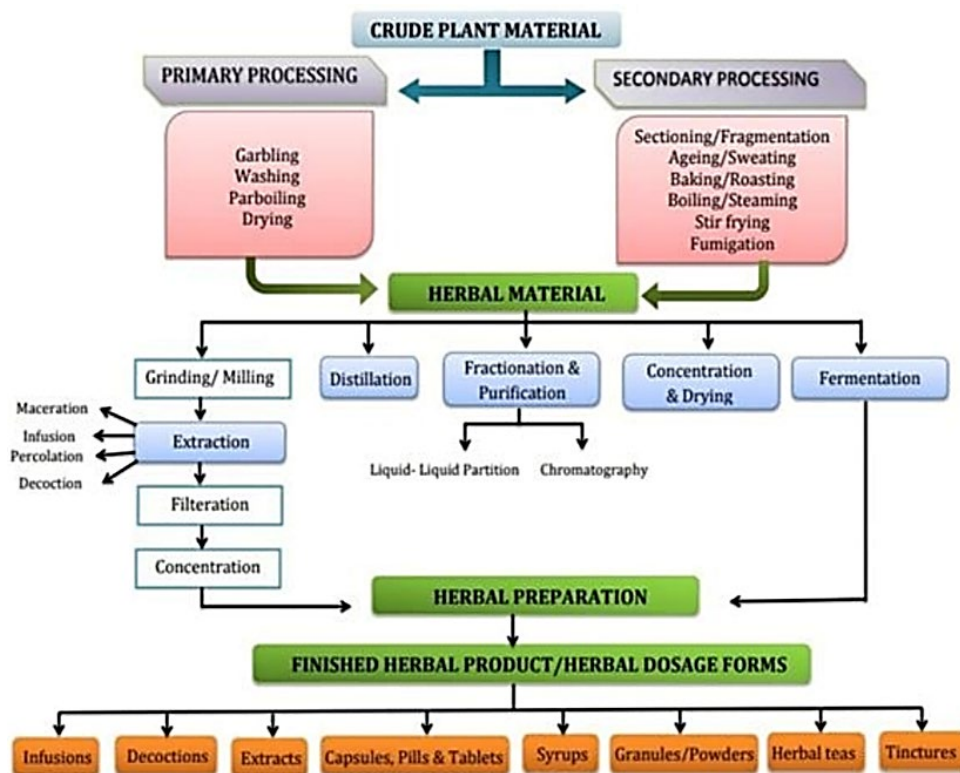


Figure 1. The processing method series for herbal medicine production and manufacturing

Table 1. Some examples of herbal extracts prepared with Nanoparticles containing herbal drugs

Herbal drugs	Purpose	Medical use
Curcumin	Solubility and bioavailability enhancement	Anti-cancer activity
Zedoary turmeric oil	Enhancement of stability, hepatoprotective activity and anti-cancer effects	Anti-cancer, hepatoprotective
Quercetin	Enhancement of antioxidant activity	Antioxidant and anti-cancer
Paclitaxel and Doxorubicin	Reduction of side effects /Avoidance of resistance	Anti-cancer activity

Table 2. Some examples of herbal extracts prepared with liposomal drug delivery systems

Herbal drugs	Purpose	Medical use
Essential oil from Atractylodes	Macrocephala Solubility and bioavailability enhancement	Anti-arthritis
Extracts of Tripterygium wilfordii (Triptolide)	Enhancement of stability,	Angiogenesis inhibitor, anti-cancer, polycystic kidney disease, digestive disorders
Quercetin	Increase in bioavailability and reduction in side effects	Anticancer / Antioxidant
Silymarin	Increase in hepatoprotective activity	Hepatoprotective

Table 3. Some examples of herbal extracts prepared with commercial Phytosome

Silybium marianum	Sylibin flavonoids	Hepatoprotective, antioxidant
Ginkgo biloba	Ginkgo flavonoids	Protects brain and vascular linings
Panax ginseng	Ginsenosides	Nutraceutical, immunomodulator
Theasinensis	Epicallocatechin	Systemic antioxidant and anti-cancer

Acalypha fruticosa, *Alangium lamarki*, and *Phytolacca americana* are the medicinal plants used to cure cancer. Other anti-cancer herbs are *Celastrus paniculatus*, *Catharanthus roseus*, *Ficus racemosa*, *Embelia ribes*, *Ficus glomerata*, *Ocimum basilicum*, *Wrightia*, *Tylophora indica*, *Terminalia chebula*, *Plumbago zeylanica*, *tinctoria*, *Buthus martensi*, *Colla cornu*, and other plant extracts are utilized in the treatment of breast cancer epimedii herb, *Radix angelicae*, *Radix bupleuri*, *Fructus lycii*, *Rhizoma corydalis*, and *Rhizom: Scolopendra subspecies, curculiginis, Radix paeoniae, Radix glycyrrhizae, and Squama manitis. The Emblica officinalis, Nigella sativa, and Emblica officinalis are herbal medicines used to treat pancreatic cancer Belleric, Terminalia (Vickers et al, 1999).*

Diabetic prevention

People have used herbal plants as home treatments for diabetes since ancient times. *Abroma augusta* and *Acacia* are two examples of herbal plants with anti-diabetic properties. Other anti-diabetic herbs are *Aconitum ferox*, *Melanoxydon*, *Acacia modesta*, *Acacia nilotica*, *Adhatoda vasika*, and *AdiantumAlthaea, Allium sativum, Adiantum incisum, Agrimoniae upatoria, capillus, Aloe barbadensis, and Commiphora abyssinica, Apium graveolens, Arctium lappa, Embilica officinalis, Ginseng panax, Gymnema sylvestre, Inula helenium, Juniperus communis, Eucalyptus globules, Orthosiphon stamineus, Panex quinquefolius, Polygala senega, Medicago sativa, Nigella sativa, Scoparia dulcis, Tanacetum vulgare, Plantago ovata, Punica granatum, Salvia officinalis, Taraxacum officinale, Tecoma supporters Trigonella foenum, Trifolium alexandrinum, a diffuse Turnera Xanthium strumarium, Zea mays, Urtica dioica, and Zingiber officinale (Jia et al,2003).*

Painkiller action

Painkiller herbs are *Ficus glomerata, Dalbergia lanceolaria, Bougainvillea spectabilis, Chelidonium majus, and Nepeta italic, Glaucium paucilobum, Polyalthia longifolia, Glaucium grandiflorum Toona ciliate, Zataria, Sida acuta, Stylosanthes fruticosa, Zingiber zerumbet, and narcotic drugs (Shang et al,2000)*

A pattern of infertility

Because the herbs have little or no negative effects, they are the main source of naturally occurring fertility-regulating substances. The plants that prevent conception are *Barberis vulgaris, Carica papaya, Amaranthus retroflexus, Arta botrysodoratissimus Dieffenbachia sp. Evodia Ruticapra Hibiscus, Ferula asafoetida, and Fatsia horrida lonicera ciliosa, magnolia virginiana, mardenia cundurango, rosasinensis, Citrus sativa, Punica granatum, Raphanus sativus, Rehmannia glutinosa, Semecarpus, and Podophyllum peltatum, Stemonia japonica, Thuja occidentalis, Taxus baccata, anacardium, Sesbania sesban, and verbena officinalis (Nandakishore et al,2007).*

Anti-aging activity

Cell membranes are vulnerable to free radical damage, impacting the cell's ability to divide and leading to a weaker immune system, aging skin, and age-related illnesses. Antioxidants play a crucial role

in neutralizing free radicals and preventing cellular oxidation. Successful antioxidants like blueberries, grape seed extract, and pine bark extract have shown effectiveness against free radicals. Allium, a commonly used plant, is also recognized for its anti-aging properties (Khan et al., 2007). Other herbs are *Arnica montana, Nigella sativa The cucumber plant, Long-leaf curcuma, Lycium, Ficus bengalensis Prunus amygdalus, Santalum album, Panax ginseng, barbarum, Ocimum sanctum, Rosa, Prunus Withania somnifera, damascene (Khan et al,2007).*

Drug delivery

The innovative drug delivery system for herbal drugs aims to direct the active components to the targeted site of action based on the body's needs and the chronopharmacology of the disease. Various Novel Drug Delivery Systems (NDDS) used with herbal drugs and phytochemicals can be broadly categorized into three groups:

- Vesicular delivery systems, including liposomes, ethosomes, phytosomes, and transferosomes (refer to Table 2 and Table 3 for details).
- Particulate delivery systems, encompassing microspheres, nanoparticles, and micropellets (refer to Table 1 for details).
- Biphasic systems, such as micro/nanoemulsions (WHO, 2017).

Antihyperlipidemic activity

The herbal extracts from *Glycyrrhiza glabra, Withania somnifera, Amaranthus spinosus, Moringa olifera, Hibiscus cannabinus, Eclipta prostrate, Lyceum barbarum, Luffa aegyptiaca, and Pilostigma thonningii* have demonstrated antihyperlipidemic activity (Salam et al., 2013).

Anti vitiligo Activity

Antivitaligo oil is a traditional herbal remedy formulated with potent herbs using traditional methods. The plants utilized in the treatment of vitiligo include *Acorus calamus, Adiantum capillus, Boswellia serrata, Cassia angustifolia, Cassia tora, Cinnamomum cassia, Fumaria officinalis, Glycyrrhiza glabra, Lavandula stoechas, Psoralea cordyfolia, Pterocarpus santalinus, Rosa damascene, Sphaetanthus indicus, Tephrosia purpuria, Vitis vinifera, Zingiber officinale, and Zizyphus sativa (Ansari et al., 2008).*

Antiarthritic activity:

The herbal extracts of *Aristolochia braceata, Ammania bacifer, Boswellia serrata Capparis spinosa, Cassia uniflora, Cleome rutidosperma, Cocculus hirsutus, Elaeocarpus sphaericus, Euphorbia atiquorum, Ficus bengalensis, Glycirrhiza glabra, Glycosmis pentaphylla, Lawsonia innermis Machalis macrantha, Phyllanthus amarus, Pistio stratiol, pongammi apinnata, Punica grantum, Randia dumetorum* have shown antiarthritic activity (Reddy et al, 2014).

Future recommendations and challenges

To close the knowledge gap between conventional herbal knowledge and contemporary scientific validation, it is essential to promote cooperation among traditional herbalists, ethnobotanists, pharmacologists, and medical researchers. This collaborative effort aims to create evidence-based herbal compositions. Additionally, to safeguard natural ecosystems and ensure the ethical treatment of indigenous tribes, it is crucial to encourage the appropriate sourcing of herbs. The production of herbal medicines should adhere to sustainable methods.

Establishing strict standards and quality control procedures is imperative to guarantee the safety and effectiveness of herbal formulations. This ensures the integrity of the products and enhances consumer and professional trust. Investing in clinical studies to verify the efficacy and safety of natural therapies is essential. Support for this crucial research may come from public funding and investments from the commercial sector.

Education is pivotal in bridging the gap between traditional and scientific perspectives on herbal medicine. Initiatives and campaigns should be created to educate the public, legislators, and healthcare professionals about the advantages and limitations of herbal medicine. This educational outreach aims to reduce suspicion and promote well-informed choices.

However, crafting comprehensive rules for herbal medications is challenging due to the vast variety of herbal treatments and the need to balance traditional knowledge with contemporary safety requirements. Standardization poses another obstacle, as achieving consistency in herbal formulations is difficult due to plant variations based on region, climate, and growth practices.

Respecting and including local and indigenous groups in herbal medicine practices while ensuring fair compensation and the preservation of their traditional knowledge presents a complex challenge. Integrating traditional herbal therapies into modern medicine is hindered by the lack of thorough scientific support. Additionally, the commercialization of herbal medicine introduces a dilemma, as balancing the interests of manufacturers in profit-making with the demands for accessibility and affordability proves to be challenging.

Conclusion

Traditional medical knowledge is widely embraced globally, with the general public incorporating it for various health needs. Despite continuous community support in developing and developed countries, a disparity exists between public preferences and national or institutional efforts for integration. The dominance of external resources, a technological focus in development, and market forces dictating distribution continue to sideline traditional medical cultures within health systems. At the turn of the new millennium, the World Health Organization (WHO) reported that the majority

of the population in most countries primarily relied on indigenous or traditional forms of medicine for everyday healthcare needs. In developed nations like the United States, plant drugs make up approximately 25% of total drugs, whereas in rapidly developing countries like China and India, the contribution is as high as 80%. Consumers express positive attitudes toward these products, perceiving them as "natural" rather than "synthetic" and safer than conventional drugs. They are viewed as part of a healthy lifestyle and a means to avoid unnecessary reliance on conventional "Western" medicine. Despite the coexistence of modern medicine, herbal medicines have maintained popularity due to historical and cultural reasons (WHO).

Author contribution

A.A.M. and M.S.S.K. wrote, drafted, reviewed and edited the paper.

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