

ADVANCING IN HERBAL MEDICINES**Pal Sarveshkumar Kanhaiyalal* and Awan Kumar Pandey**

S.N. College of Pharmacy Babupur Jaunpur.

Article Received on
12 March 2025,Revised on 02 April 2025,
Accepted on 22 April 2025

DOI: 10.20959/wjpr20259-36436

***Corresponding Author****Pal Sarveshkumar****Kanhaiyalal**

S.N. College of Pharmacy

Babupur Jaunpur.

ABSTRACT

Herbal medicine forms a backbone of India's diverse health care systems such as Ayurveda, Yoga, Unani, Homeopathy, and Naturopathy, in which more than 70% of the population depend upon such traditional systems. Though herbal drugs are not individually classified under the Indian Drugs Act, they do possess much experiential evidence and can thus offer avenues for Observational Therapeutics and Reverse Pharmacology. Evidenced-based herbal formulation prepared according to pharmacopoeial standards are well established and consumed extensively with Indian medicinal plants providing considerable scope for disease prevention and treatment. Nevertheless, the challenges in establishing robust analytical techniques for characterizing the phytochemical profile of herbal medicines. Standardization is essential to ensure consistent quality,

biological activity, and chemical profiles. WHO guidelines for the evaluation of safety, efficacy, and quality are important for global harmonization. New extraction techniques like microwave-assisted and supercritical phase extraction are improving compound yield, while spectroscopic and chromatographic methods facilitate standardization. Nanotechnology is also enhancing the solubility and bioavailability of herbal medicines, opening the door to more effective therapies. Herbal medicine, the backbone of traditional healthcare systems across the globe, is facing a revolutionary change with the infusion of modern scientific methods. The present paper delves into the progress of herbal medicine, focusing on the complementarity between traditional knowledge and current research methods. Advances in phytochemistry, pharmacology, and molecular biology in recent years have shed light on the therapeutic potential of many plant-derived compounds, resulting in the identification of new bioactive compounds with high medicinal value. In addition, the progress in clinical trials and standardized extraction methods has improved the validity and effectiveness of herbal

remedies. The article also discusses the problems created by quality control, regulatory systems, and the necessity for evidence-based practices to provide safety and efficacy. By integrating ancient wisdom with modern science, herbal medicine continues to increase its position in international healthcare, providing sustainable and integrative therapeutic alternatives.

KEYWORD: Herbal drugs, Indian medicinal plants, Therapeutics, Herbal formulation, Standardization, Nanotechnology.

INTRODUCTION

Herbal medicine, or botanical or plant medicine, refers to naturally occurring, plant-derived substances that need little industrial processing and have been a mainstay of traditional healing for centuries. These medicines, rooted deeply in the history of human civilization, were widely used long before the development of allopathic medicine, acting as therapeutic agents for a broad range of diseases. Phytomedicines, formulated in the form of tinctures, teas, poultices, powders, and crude pharmaceuticals, have set the stage for numerous novel drugs. For example, aspirin, a derivative from willow bark, and morphine, harvested from opium poppies, are representative of modern-day herbal remedy-inspired medicines. India, a world leader in traditional systems of medicine such as Ayurveda, Unani, Siddha, and Homeopathy (AYUSH), is a major player in the herbal medicine sector.

Even with the annual valuation of the herbal industry at Rs. 10 billion and its large export of raw materials and finished products, India contributes only 1% to the world herbal export market. The lack of use of India's vast biodiversity and traditional knowledge has restricted its potential to cash in on increasing global market demand for herbal products.

World Health Organization (WHO) recognizes the significance of safety, efficacy, and quality control of herbal medicines, given their universal use in health care. With around 80–90% of the world's population using plant-based medicines, herbal drugs have gained irreplaceability for the treatment of numerous chronic as well as infectious diseases, including asthma, diabetes, arthritis, cancer, and Alzheimer's disease.

Furthermore, herbal products exhibit multifarious therapeutic activities, including antimicrobial, anti-inflammatory, antidiabetic, sedative, and memory-enhancing activities. In view of increasing fears regarding the side effects and toxicity of synthetic drugs, the need

for herbal medicines has increased. These drugs, which are generally perceived as safer, more convenient, and cheaper, are an integral part of traditional and contemporary health care systems globally.

These medicines, often considered safer, more accessible, and cost-effective, are integral to traditional and modern healthcare systems worldwide. This review delves into the advancements in herbal medicine, highlighting current research, applications, and the potential of this age-old practice in addressing contemporary health challenges.

Advantages of herbal drugs

Herbal medicines have been part of healthcare systems for centuries and are still commonly used because of their many advantages. The following are the major benefits of herbal medicine:

1. Natural and Readily available

Herbal medicines are directly extracted from plants and are plentiful in nature, making them readily available to individuals, especially in rural and low-resource areas.

2. Cost-Effective

Herbal medicines are generally cheaper to manufacture and buy compared to allopathic medicines, and therefore they are an affordable choice for a broad population.

3. Fewer side effects

Herbal remedies tend to be safer than synthetic drugs since they have fewer and milder side effects. This, in turn, makes them an ideal selection for long-term use in the treatment of chronic conditions.

4. Rich therapeutic properties

Herbal medicines have varying pharmacological activities, which include anti-inflammatory, antimicrobial, antidiabetic, antioxidant, sedative, and hepatoprotective effects. These effects allow them to treat several diseases at a time.

5. Cultural and Historical acceptance

Since deeply rooted in ancient medicine systems, like Ayurveda, Traditional Chinese Medicine, and Unani, herbal medication is widely accepted and trusted by populations worldwide.

6. Maintains immune system

Most herbal preparations have been found to bolster the immune system, making the body immune to diseases and recover from ailments easily.

7. Eco-friendly

The process of manufacturing herbal medicines often involves less industrial processing and chemical use, leading to a reduced environmental impact than in the case of synthetic drugs.

8. Age-old Safety record

Herbal medicines have weathered thousands of years of human experimentation, and their safety and safety well-documented in traditional practices.

9. Adaptability in preparation

Herbal medicine may be prepared in any of a number of forms tinctures, teas, powders, poultices, or extracts enabling variability in administration according to individual requirement. These benefits underscore the importance of herbal medicine in traditional and contemporary healthcare systems, offering an effective and sustainable approach to maintaining well-being and treating a wide range of medical conditions.

Disadvantages of herbal drugs

Even with their many advantages, herbal medicines also possess some limitations and problems. Some of the major drawbacks are listed below:

1. Limited availability of herbal drugs

Although herbal drugs are in great demand, the availability of some medicinal plants might be limited owing to seasonal growth, geographical restrictions, or overharvesting. Such shortages can impact the regular supply of raw materials required for herbal formulations.

2. Lack of Proper Arrangements in Preparation and Use

Preparation and delivery of herbal medicines tend to lack organized processes and infrastructure. Poor arrangements in cultivation, harvesting, storage, and manufacturing may undermine the quality and efficacy of herbal drugs.

3. Difficulty in standardization

Herbal drugs suffer from serious difficulty in getting standardized because there are differences in plant composition. Soil quality, climate, and reaping methods cause variable

concentrations of active components, making uniform therapeutic results challenging to provide.

4. Risk of poisoning from wild herbs

Certain wild or misidentified herbs possess toxic properties when ingested in the absence of proper knowledge or processing. For instance, some plants have toxic alkaloids or other poisonous substances, which are harmful to users.

5. Inappropriateness for Sudden Disease and Accidents

Herbal drugs are usually inappropriate for acute medical conditions or life-threatening situations, e.g., heart attacks, strokes, or major injuries, because of their delayed action and less immediate response.

6. Lack of proper dosage instructions

Unlike synthetic medicines, herbal drugs frequently do not have proper dosage instructions, resulting in difficulties in ascertaining the proper quantity for safe and effective application. Overdose or underdose may diminish efficacy or cause undesirable side effects.

7. Slower treatment duration

Herbal remedies generally take time to exhibit results in contrast to pharmaceutical drugs. This tends to make them less suitable for ailments that need prompt treatment since they are based on gradual healing as well as natural processes. Mitigating to these setbacks by means of scientific study, regulatory systems, and eco-friendly practices is vital to unlocking the potential of herbal remedies to the fullest while limiting its risks.

Usage and Preparation of herbal drugs

The efficacy of herbal medicine largely relies on the user's patience and attitude.

Used properly, herbal drugs have the capability of offering safe and effective remedies for various diseases. Yet, the strength and therapeutic potential of such drugs greatly differ, depending on factors like plants' genetic difference, cultivation conditions, harvesting time and mode, exposure to environmental factors like air, sunlight, and water, and preservation techniques.

Herbal drugs are cultivated and processed locally or imported from across the globe. The fresh herbal ingredients used for making herbal medicines are carefully processed, either being grown plants or gathered from the wild. These plants, having been harvested, go

through precise processing to establish their effectiveness and safety. According to the World Health Organization (WHO), three types of herbal medicines exist.

1. Raw plant material

It consists of unprocessed parts of plants used for medicinal treatment.

2. Processed plant material

It denotes plant material that has been processed to some extent but is not in a final medicinal form.

3. Medicinal herbal products

They are final products that incorporate active ingredients obtained from plants and are meant to be used therapeutically.

Common forms of herbal drugs

Herbal drugs exist in various forms and tend to need proper preparation prior to use. The following are some typical ways of preparation:

1. Bulk Herbs for Teas and Decoctions

Dried plants or plant parts are usually bought in bulk by herbal firms and packaged for use as herbal teas or decoctions.

- Decoctions: Here, herbs are boiled in a specified amount of water for a predetermined time, followed by straining off plant material.

The liquid is then cooled, filtered, and concentrated to produce a strong herbal preparation.

2. Hydro-Alcoholic tinctures

Tinctures mean that plant material is soaked in a combination of alcohol and water in order to extract active compounds. The tinctures are very concentrated herbal drugs, providing a long shelf life and convenience of use.

3. Fluid extracts

Fluid extracts represent another concentrated herbal medicine, produced by treating herbs in a liquid medium to preserve the plant's therapeutic components. The preparation process of herbal drugs sometimes relies on the nature of the plant's active chemical compounds. Adequate preparation ensures the maintenance of these compounds, which is vital for obtaining the expected therapeutic effects. This careful approach emphasizes the importance of handling and preparing herbal medicines accurately to gain the maximum benefits.

Herbal Preparations and Traditional medicines are quite different when it comes to effectiveness

1. Composition and Complexity

Herbal formulations are complex mixtures obtained from plants, consisting of several active compounds that may act synergistically. Conventional drugs, on the other hand, usually have a single active ingredient that has been engineered for a particular therapeutic action.

2. Absorption and Bioavailability

Herbal drugs tend to be poorly absorbed when they are taken orally, thus limiting their effectiveness. This is because the complex nature of phytochemicals in herbal products may not be as bioavailable as the active ingredients in traditional drugs.

3. Standardization and Quality Control

The efficacy of herbal preparations may be greatly variable owing to variation in plant sources, preparation, and control. Conventional drugs, on the other hand, are tested thoroughly and standardized for consistency in potency and performance.

4. Safety and Side Effects

Herbal medicines are generally thought to be safe and natural. However, they can produce health issues, such as side effects and interaction with other drugs. Conventional drugs also have side effects, though these are generally well- documented tracked. Overall, although herbal preparations have become popular and accepted as therapeutic substances, their activity can be unpredictable in comparison with the more consistent results produced by conventional drugs.

Nanotechnology in herbal medicine

Nanotechnology, matter manipulation at the nanoscale, has been identified as a promising device to improve the effectiveness and safety of herbal drugs. Through customization of herbal compound properties at the nanolevel, scientists hope to bypass the shortcomings that have been seen with conventional formulations, including poor bioavailability, poor solubility, and high degradation. Improved bioavailability of active constituents is one of the major benefits of nanotechnology for herbal drugs.

Most phytochemicals have poor solubility and as a result are not easily absorbed from the gastrointestinal tract. Through the encapsulation of these compounds into nanoscale delivery

vehicles, such as liposomes, polymeric nanoparticles, or solid lipid nanoparticles, their permeability and solubility can be greatly improved, resulting in enhanced bioavailability and therapeutic effectiveness. In addition, nanotechnology facilitates targeted drug delivery, making it possible to deliver herbal compounds to specific locations of action precisely. Targeted delivery can minimize systemic side effects and enhance the therapeutic index of herbal drugs. For example, nanoparticles can be engineered to reach specific cells or tissues, for example, cancer cells or inflamed tissues, maximizing therapeutic effect while reducing off-target effects. Besides bioavailability and targeted delivery, nanotechnology can enhance the stability and shelf life of herbal preparations.

Nanoparticles can shield phytochemicals from degradation by light, heat, and oxidation, making them retain their potency and efficacy over time. This is especially critical for herbal compounds that are prone to degradation during storage or administration. Various studies have shown the potential of nanotechnology in enhancing the therapeutic efficacy of herbal medicines. For instance, curcumin, a polyphenol with strong antioxidant and anti-inflammatory activities, has low bioavailability because of its poor solubility. Encapsulating curcumin in nanocarriers has allowed researchers to attain much greater bioavailability and therapeutic effectiveness in a variety of disease models. Although nanotechnology presents great promise for the development of herbal medicine, caution should be exercised to mitigate potential problems and safety issues.

Stringent toxicity testing is required to ensure the safety of nanomaterials and their interactions with biological systems. Standardized manufacturing procedures and quality control measures play a pivotal role in ensuring the reproducibility and consistency of nano formulated herbal products. Nanotechnology holds the promise to revolutionize the practice of herbal medicine by overcoming many shortcomings inherent in conventional formulations. Through enhancing bioavailability, facilitating targeted delivery, improving stability, and minimizing side effects, nanotechnology has the capacity to realize the maximum therapeutic potential of herbal compounds.

Much more research and development, however, are required to convert these highly promising results into clinically useful and safe nano formulated herbal medicines.

Adverse drug reaction

Herbal remedies are extensively consumed for their purported health benefits, but, similar to

conventional pharmaceutical medications, they can have adverse drug reactions (ADRs) as well. These reactions may vary from mild side effects to severe, even life-threatening conditions. One must note these possible hazards, particularly when herbal remedies are combined with other medications. Following are a few instances of commonly consumed herbs and the adverse drug reactions that may result from them:

1. Paprika

Adverse reactions:- Perhaps the most prevalent side effect of paprika is headache. Although this is normally mild, it may be inconvenient for sensitive persons. Since paprika does have capsaicin in it, it will also cause some people gastrointestinal distress, although this is less likely.

2. Ginkgo biloba

Adverse reactions: Ginkgo biloba is commonly used for possible cognitive benefits, but it can enhance the risk of spontaneous bleeding owing to its blood-thinning properties. Patients on anticoagulant therapy or with bleeding disorders should not use ginkgo since it interacts with medications like warfarin, boosting the risk of internal bleeding.

3. Ephedra (Ephedrine)

Adverse reactions: Ephedra, used commonly for weight loss or as a stimulant, can have multiple dangerous adverse effects, including hypertension, cardiac arrhythmias, anxiety, insomnia, tremors, seizures, myocardial infarction (heart attack), nervousness, and kidney stones. These side effects can be especially dangerous when ephedra is ingested in large doses or combined with other stimulants, including caffeine.

4. Piper methysticum (Kava)

Adverse reactions: Kava is most often taken for its sedative and calming effects, but it causes severe liver toxicity, which can cause liver failure in rare cases. Other side effects are torticollis (Neck stiffness), sedation, rash, and worsening of Parkinson's disease symptoms, such as involuntary trunk movements and painful twisting. These reactions make Kava a potentially dangerous herb, especially with long-term consumption or in individuals with pre-existing liver disease.

5. St. John's Wort

Adverse reactions: St. John's Wort, taken mostly for its antidepressant properties, can lead to a wide range of side effects such as dry mouth, gastrointestinal upset, dizziness, allergic

reactions, and photosensitivity (Enhanced sensitivity to sunlight, resulting in an increased risk of sunburn).

St. John's Wort also exerts notable drug interactions, since it induces the liver enzymes that can compromise the efficacy of some medications, such as oral contraceptives, anticoagulants, and immunosuppressants.

6. Chaste Tree Fruit (Vitex)

Adverse reactions: Chaste tree is commonly employed to balance hormone imbalances, especially in females. Nevertheless, it may cause diarrhoea, particularly if taken in excess amounts. Other gastrointestinal problems, including bloating or nausea, have also been experienced by some patients.

Herbal-Drug Interaction

Herbal drugs, in many ways seen as natural and safe alternatives to orthodox medicine, may interact with allopathic (Pharmaceutical) drugs in a way that will change their effectiveness, cause unwanted reactions, or even result in life-threatening outcomes. Such interactions may take place due to alteration in pharmacodynamics (The mode of action of a drug on the body) and pharmacokinetics (The body's process of absorption, distribution, metabolism, and excretion of a drug). Although herbal medicines are extensively used for their curative action, their interactions with prescription drugs should not be taken lightly.

Types of Herbal-Drug Interactions

1. Pharmacokinetic interactions

Pharmacokinetic interactions result when herbs affect the absorption, distribution, metabolism, or excretion of orthodox drugs. Several herbal medicines can increase or decrease the blood concentration of a drug, changing its efficacy or toxicity.

2. Pharmacodynamic interactions

Pharmacodynamic interactions result when two or more drugs or herbs increase or decrease an effect when administered together, irrespective of their metabolic conversion. These interactions may result in enhanced or diminished therapeutic effects, or increased adverse effects.

3. Contamination by Heavy Metals and Herbal

Some conventional herbal drugs, particularly those produced in specific areas, have been

found to contain heavy metals like lead, copper, arsenic, silver, gold, or mercury. These metals have the potential to accumulate in the body and cause toxicity, resulting in serious organ damage, particularly the liver and kidneys.

This contamination, added to the impact of the herbal drug, could increase the risk of organ toxicity and cause long-term health complications.

Clinical implications of herbal-drug interactions

The clinical relevance of herbal-drug interactions depends on various factors, such as the concerned herb, the pharmacokinetic and pharmacodynamic characteristics of the drugs involved, and the health status of the patient. For instance:

- Patient-related factors like age, liver function, kidney function, genetic differences in drug- metabolizing enzymes, and overall health status may affect how drugs and herbs interact. A patient with liver dysfunction may show more intense interactions with enzyme- inducing herbs such as St. John's Wort.
- Polypharmacy, or the administration of multiple medications, increases the potential for interactions, especially in elderly patients or those with chronic illnesses needing long-term medication treatment.
- Dosage and timing of herbal drugs and pharmaceutical drugs also have a critical impact. For example, administration of herbs in high doses or over long periods increases the potential for meaningful interactions.

Stability testing of herbal drugs

Stability is defined as the ability of a product to retain its intended physical, chemical, microbiological, and therapeutic properties over time under certain storage conditions. Stability testing guarantees herbal drugs to be safe, effective, and of uniform quality over their shelf life.

Herbal medicines, being different from synthetic drugs, are obtained from plant material and tend to be mixtures of complex active constituents, which are prone to influence by environmental factors like temperature, humidity, light, and oxygen.

Stability testing for herbal drugs must, therefore, be a detailed exercise to test how these factors influence the quality and strength of the final product.

Regulatory status of herbal drug

India boasts a long history of herbal medicine, and the regulation of herbal products is controlled by the Drugs and Cosmetics Act (1940) and the AYUSH Ministry (Ayurveda, Yoga & Naturopathy, Unani, Siddha, and Homoeopathy).

- **Regulation:** Herbal products are regulated as drugs under the Drugs and Cosmetics Act when they make medicinal claims. Numerous traditional products are exempted from extensive clinical trials when they fall under the category of traditional or Ayurvedic.
- **Good Manufacturing Practices (GMP):** Herbal drug manufacturers are required to adhere to GMP standards, and the Ministry of AYUSH issues special guidelines for the production of herbal medicines.
- **Traditional Use:** Similar to the EU, herbal products that are used for long-standing practices (e.g., Ayurveda) can be registered on the basis of traditional knowledge and use, without the need for modern clinical evidence.

Future scope of herbal medicine

The future of herbal medicine is bright, with increasing consumer interest in natural products and the increasing integration of traditional remedies with modern science. Here are the key trends shaping its future:

1. Rising consumer demand

More people are seeking natural, sustainable alternatives to synthetic drugs, especially as they become more health-conscious and concerned about side effects. Herbal remedies are popular among aging populations and eco-conscious consumers.

2. Integration with contemporary medicine

Herbal medicine is being more and more combined with standard medical practice. Phytopharmaceuticals (Herbal products containing standardized active constituents) and evidence-based research are enhancing credibility and acceptance in mainstream health care.

3. Personalized medicine

Developments in genomics and pharmacogenetics could see personalized herbal medicine, with treatment tailored to the genetic makeup, life situation, and state of health of an individual.

4. Preventive healthcare

Herbal medicine is becoming more popular in disease prevention and management, including

diabetes, heart disease, and mental health issues. Herbs such as Turmeric, Ashwagandha, and Ginseng are being investigated for their therapeutic properties.

5. Technological progress

Biotechnology, metabolomics, and phytochemistry are facilitating the identification and optimization of the active ingredients in herbs, enhancing consistency, potency, and efficacy.

6. Regulation and Quality Control

With increasing demand, tighter regulations will be essential to guarantee product safety, quality, and consistency. GMP (Good Manufacturing Practices) and sustainability and ethical sourcing certifications will become more prevalent.

7. Sustainability

Sustainable farming and responsible harvesting practices will be essential to conserve biodiversity and provide a reliable source of medicinal plants, particularly as global demand increases.

8. Cosmetics and Beauty

Herbal ingredients are being increasingly utilized in skincare and anti-aging products because of their natural, calming, and antioxidant nature. Herbs such as Aloe Vera and Green Tea are in great demand for such uses.

9. Addressing global health challenges

Herbal remedies could be instrumental in fighting antimicrobial resistance and maintaining immune health. Plants with antibacterial and antiviral activities are being researched for their therapeutic application in the management of infections and maintenance of immune function, particularly following global pandemics such as the COVID-19 pandemic.

SUMMARY

Recent developments in herbal medicine are aimed at integrating traditional wisdom with contemporary science. Scientists are now isolating active ingredients in herbs and scientifically proving their efficacy.

Herbal preparations are being standardized for quality and safety, and are increasingly used in conjunction with conventional medical therapy. Biotechnology assists in cultivating rare

plants and augmenting medicinal properties. Regulations across the world are getting better to guarantee safe usage, and individualized herbal therapies are on the horizon based on individual health profiles.

Herbal medicine has undergone great advancement in recent decades with traditional practice more and more underpinned by contemporary scientific evidence. One of the greatest achievements is the identification and examination of active constituents of medicinal plants by phytochemistry. Such findings have facilitated greater knowledge about the mechanism of action of herbal medicines, thus making them more effective and having specific applications.

Standardization is yet another significant evolution, guaranteeing uniformity in the quality, dosage, and safety of herbal products. New extraction technologies and quality control procedures have succeeded in minimizing contamination and adulteration, thereby rendering herbal preparations more consistent and more widely accepted.

Biotechnology is also central to the development of herbal medicine. Plant tissue culture and genetic engineering are among the methods applied to improve the yield and quality of medicinal chemicals, and to protect vulnerable plant species from extinction.

Additionally, incorporation into mainstream medicine is increasing, as numerous health systems incorporate complementary and integrative medicine involving herbal medicine.

Global awareness and regulation have increased, with institutions such as the WHO promoting safe procedures.

Genetically and patient health profile-based personalized herbal medicine is a nascent trend that is promising in terms of more efficacious and individualized treatments.

CONCLUSION

Herbal medicine has been a mainstay of global healthcare for centuries, providing enormous advantages not just for the treatment of disease but also for overall health and wellness. Identified by the World Health Organization (WHO), herbal medicines like *Artemisia annua* have even been found to hold promise against new health challenges such as the novel coronavirus. In nations such as India, where more than 70% of the population rely on herbal remedies, there is abundant traditional knowledge and an expanding evidence base verifying

their therapeutic worth. Yet, to maximize the potential of herbal medicines, standardization, quality control, and intense research into their safety and efficacy are urgently needed.

Modern scientific methods, in collaboration with traditional knowledge, can result in more effective herbal products, providing affordable healthcare options, particularly in areas with poor access to costly conventional medicines. As people become more aware, the herbal industry is on the verge of major breakthroughs, making a contribution to world health and wellness in the future years.

Breakthroughs in herbal medicine have propelled it from classical practice to an increasingly scientifically proven and internationally respected mode of healing. Through modern science, standardization, biotechnology, and integration with allopathic medicine, herbal medications are becoming more effective, safe, and accepted. With rising interest in nature-based and person-specific therapies, herbal medicine can play a crucial role in adding to modern healing and facilitating more holistic methods towards well-being.

The development of herbal medicines is a major transition in world medicine, combining centuries of traditional practice with contemporary scientific technology. With scientists increasingly proving the therapeutic values of many medicinal plants, herbal remedies are acquiring legitimacy and increased use in both clinical and community practice. Methods of phytochemical analysis, sophisticated extraction, and clinical testing have enhanced knowledge of the safety, dosage, and effectiveness of herbal therapies.

Additionally, standardization and quality control have ensured uniform product quality, and biotechnology has made it possible to cultivate medicinal plants sustainably, even the rare and endangered ones. Blending herbal medicine with conventional medical practice has opened the door to more holistic and individualized care for health, enabling patients to enjoy the benefits of both worlds.

Regulatory changes and international initiatives by agencies such as the World Health Organization have also facilitated the safe and effective application of herbal products. The future will depend on ongoing research, innovation, and partnership between traditional practitioners and modern scientists to unlock the maximum potential of herbal medicine. As natural and personalized health care options gain popularity, herbal medicine has a bright future as an even more significant contributor to future health systems.

REFERENCE

1. Dhritiman Roy, Arindam Chakraborty, Payel Mukherjee, Balaram Ghosh and Manas Chakraborty, Recent Advances in Herbal.
2. Medicines – An Updated Review Neeraj Choudhary and Bhupinder Singh Sekhon, An overview of advances in the standardization of herbal drugs.
3. Vaidya, A. D. B., & Devasagayam, T. P. A. Current Status of Herbal Drugs in India: An Overview, 2023.
4. Chandel HS, Pathak AK, Tailang M. Standardization of some herbal antidiabetic drugs in polyherbal formulation. J Pharmacog Res, 2011.
5. Meena AK, Rao MM, Panda P, Kiran, Yadav A, Singh U, et al. Standardisation of ayurvedic polyherbal formulation, Pancasama Churna. Int J Pharmacog Phytochem Res, 2010.
6. Sanjay J, Sweta S, Rakesh B, Praveen K. Standardization of ‘Dashamularishta’: A polyherbal formulation. Pharmacog J, 2009.
7. Mukherjee PK, Venkatesh M, Kumar V. An overview on the development in regulation and control of medicinal and aromatic plants in the Indian System of Medicines. Bol Latinoam Caribe Plant Med Aromaticas, 2007.
8. Cardini F, Wade C, Regalia AL, Gui S, Li W, Raschetti R, Kronenberg F. Clinical research in traditional medicine: priorities and methods. ComplTher Med, 2006.
9. Devasagayam, T. P. A., and K. B. Sainis. Immune System and Antioxidants: Especially Those Involved with Indian Medicinal Plants. Indian Journal of Experimental Biology, 2002.
10. World Health Organization (WHO). WHO Global Report on Traditional and Complementary Medicine, 2019.