

Herbal Medicine and Its Importance in Healthcare

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Abstract

It is generally accepted by all concerned that modern pharmaceuticals will remain out of reach of many people and 'health for all' may only be realized by the use of adequately assessed herbal products. Mankind has been using herbal medicine for healing right from the beginning of human civilization. With the advent of 'modern medicine' herbal products have been looked down upon, especially by western societies. Yet, in recent times, use of herbal medicine for healthcare has increased steadily all over the world. However, serious concerns are being realized regarding the safety, claimed efficacy and quality of herbal products used as herbal medicine, nutraceuticals, health food and cosmetics. Although herbal products are generally considered safe due to their age-old usage, significant side effects have been reported for many herbal products, including herbal medicine. Accidental contamination and intentional adulteration are considered as primary reasons for the side effects. The historical perspective and the philosophy of herbal medical practice along with its present status in the light of present day science have been reviewed and included in the present article. Assurance of safety by identification of contaminants and assessment of toxicity has been outlined. Assessment of claimed efficacy of herbal medicine is difficult due to its holistic approach. Practical ways of assessing efficacy of herbal medicine by adapting the methodologies used for modern pharmaceutical are described. The maintenance of standard of herbal medicine has been stressed and pragmatic approaches of assuring quality of herbal medicine by using modern tools of fingerprinting the chemical profile of herbal medicine are discussed. As much of the traditional herbal medical knowledge is scattered around the world at the family and community levels, and more so in the indigenous people, the knowledge base is continuously being lost and so needs immediate documentation. Difficulties in documentation due to concerns of Intellectual Property Rights (IPR) have been highlighted.

Key words: Herbal medicine, Holistic approach, Safety, Adulteration, Efficacy, Standardization, Fingerprinting, Documentation, Intellectual property rights.

Introduction

The word medicine is derived from the Latin *arsmedicina*, meaning *the art of healing*. Today medicine is usually defined as *the science and art of healing* involving a variety of healthcare practices evolved to restore health by the prevention and treatment of illness in human beings. Contemporary medicine applies modern medical methodologies to diagnose and treat injury and disease. In prehistoric traditional medicine, plants, animal parts and minerals were, in many cases, used ritually as magical substances on the basis of spiritualism or mystic powers. In recent times herbal medicine is more organized as Traditional Chinese Medicine (TCM) in China, and Ayurveda & Unani medicine, mainly in the Indian subcontinent.

Although herbal medicines have been used as therapeutic agents for human healthcare throughout the human civilization, their use has been challenged by the advent of semi-synthetic and synthetic drugs since the nineteenth century, and more so in the twentieth century. Yet, in recent times, the consumption of plant-based

medicines and other botanicals has increased manifold, especially in EU countries and North America. Global sale of herbal medicines and other products is already over US \$ 100 billion and is estimated to exceed US \$ 1 trillion in the next 20 years.

It has been realized that modern pharmaceuticals will remain inaccessible and unaffordable to a large proportion of the human population. Moreover, increasing reports of adverse side effects and bacterial resistance to antibiotics are making synthetic drugs less attractive. Therefore, to realize the goal of health for all, it is necessary to use human knowledge of herbal medicine, which is underutilized and often has not been properly studied scientifically. The World Health Organization (WHO) recognized this fact in the early 1970s and encouraged governments to utilize effectively local knowledge of herbal medicines for disease prevention and health promotion. Herbal medicines, however, suffer from a range of shortcomings due to insufficient and unacceptable evidence of safety, efficacy and inconsistent quality. The challenges of modernizing herbal medicine for universal use and how to overcome these problems have been summarized in this article. As scientific techniques have become more powerful, and the capability to apply them in countries rich in medicinal plants has increased, there is a growing possibility of combating the challenges. Incidentally, this is also an opportunity for the tropical less-developed countries to add value to their bio-resources and reduce poverty. For this purpose a global initiative is required and cooperation between scientists has to increase to either diminish or remove the present obstacles.

Herbal medicine

Although the Egyptian Imhotep (3rd millennium BC) is the first physician in history known by name, the first generally accepted use of plants as healing agents was depicted in the cave paintings in Lascaux in France, radio-carbon dated to 13,000 – 15,000 BCE. Medicinal herbs were found in the personal effects of an 'Ice man' whose body was frozen in the Swiss alps for more than 5,300 years, which appears to have been used to treat the parasites found in his intestine [1]. In sickness, animals look out for bitter plants rich in tannins and alkaloids [2]. The use of herbs and spices in cuisine were developed in tropical countries as a response to food-borne pathogens. Studies show that spices with more potent antibacterial activity are selected [3]. In all cultures vegetables are spiced less than meat, because they are more resistant to spoilage [4]. In light of the growing resistance of parasites and pathogens to synthetic drugs, the study of animal self-medication and ethno medicine offers a novel line of investigation to provide plant-based medicines for populations and their livestock living in the tropics.

MEDICINAL PLANTS AND HERBS



LICORICE



HENBANE



OLEANDER



MARS-MALLOW



GREATER BURDOCK



COMFREY



THISTLE



POPPY



HOP



INULA



COLTSFOOT



ARNICA



ROSE OF PROVINS



BORAGO



Rosemary



Red sorrel



Tarragon



Basil



Dill



Thyme



Lavender



Bay leaf



Parsley



Chives



Spinach



Sage



Watercress



Lemongrass



Oregano



Arugula

Some Medicinal Plants And Herbs Image

Recorded use of plants as medicine date back 5,000 years to the Sumerians [6] and the Vedas. The written text of Rig Veda came about 2,000 years ago [7]. Current practice of Ayurveda is based on the Ayurvedic Pharmacopoeia of India [8], and the CRC Handbook of Ayurvedic Medicinal Plants [9]. Although the standardized format of Traditional Chinese Medicine (TCM) was created in the 1960s [10], it can be traced back to 2700 BCE. Other relevant sources are the Chinese Materia Medica: Chemistry, Pharmacology and Applications [11] and the Pharmacopoeia of the Peoples' Republic of China [12]. The Unani (Arabic name for Greek) system of medicine originated in Greece with Galen, but was later enriched by the Arabs and Persians. The Unani system came to India around the 10th century and became an important system of medicine in the Indian subcontinent after Ayurveda. The Siddha system of medicine introduced by saints in south India is used in that area to a limited extent.

While long standing herbal medical systems thrived in China and India, there is hardly any systematic record of herbal medicine in the Americas. Just about a decade ago a materia media came out on Native American Ethnobotany [13]. This rich document describes hundreds of plants which have entered general human use through Native contact with European, African and Asian peoples [14]. Although a very high percentage of people in Africa depend on herbal treatments, they are hardly documented and poorly regulated [15]. Recently, a pan-African pharmacopoeia was being assembled. Besides the major systems of use of herbal medicine there are local and regional methods and numerous pharmacopoeia, materia medica, books and monographs available.

Practically all systems of herbal medicine take a holistic approach where the physical, mental and social well-being of an individual are considered collectively for the treatment of a particular medical condition. Traditional medicine, including herbal medicine, implies knowledge and practice of herbal healing for the prevention, diagnosis and elimination of physical, mental or social imbalance [16]. Herbal medical practitioners or herbalists view their field as a study of a web of relationships rather than a quest for a single condition, as most modern medical practitioners do. Herbalists also view their goal as prevention as well as cure. They argue that different phytochemicals present in many herbs will interact with synergy and multifunctionality to enhance the therapeutic effects of the herb and dilute toxicity. Although in specific cases the claim of synergy [17] and multifunctionality [18] have been supported by scientific evaluation, generalization is difficult. The argument is that plants under selection pressure develop resistance to threats such as radiation, reactive oxygen species and microbial attack and herbs may simultaneously address several of these factors. Synergistic interactions are of vital importance in phytomedicines to explain difficulties in always isolating a single active ingredient, and explain the efficacy of apparently low doses of active constituents in a herbal product. This concept that a whole or partially purified extract of a plant offers advantages over a single isolated ingredient also underpins the philosophy of herbal medicine. However, most herbalists concede that pharmaceuticals are more effective in emergency situations, for example when a patient has elevated blood pressure threatening imminent danger. However, they claim that over the long term, herbs can help the patient resist disease and in addition provide nutritional and immunological support that pharmaceuticals lack.

Safety

Plants and herbs produce various chemicals for their metabolic activities and to protect them from disease and predators. Primary metabolites like carbohydrates and fats are found in all plants, whereas secondary metabolites useful as therapeutic agents are produced by most plants. Some secondary metabolites are toxins used to prevent predation, and others are pheromones to attract insects for pollination. Allelochemicals inhibit rival plants competing for soil and light and, phytoalexins protect against bacterial and fungal attacks.

The chemical profile of a plant varies with time and place as it reacts to changing conditions. Major classes of phytochemicals useful for therapy produced by plants include alkaloids, phenolics, flavonoids, terpenoids and glycosides. The word 'drug' itself comes from the Swedish word 'druug', which means dried plant. Inulin from the roots of dahlias, quinine from cinchona, morphine and codeine from poppy, digoxin from foxglove and a precursor of aspirin from willow bark are some examples of drugs directly derived from plants. Isolation of hundreds of compounds from medicinal plants are reported in the scientific literature, but only a few new drugs from plant sources have been developed in recent times. A point of interest is that most compounds are extracted from plants by water or alcohol and the composition may vary widely with the method and solvent of extraction.

Interest, use and trade in herbal medicine have increased dramatically in the last few decades [18] and global sales are predicted to exceed 1 trillion US dollars in 20 years from its present market of about 100 billion US dollars. This has made many pharmaceutical industries interested in production and marketing of herbal medicine.

Historically, about two centuries ago, our medical practices were largely dominated by plant-based medicines. However, the medicinal use of herbs went into decline in the West when more predictable synthetic drugs were made commonly available. In contrast, many developing nations continued to benefit from the rich knowledge of medical herbalism. For example, Ayurvedic medicine in India, Kampo medicine in Japan, Traditional Chinese Medicine and Unani medicine in Middle East and South Asia are still used by a large majority of people. In the recent era of herbal renaissance, the demand of herbal medicine and other botanicals by Western communities has been increasing steadily. TCM, represented by acupuncture and herbal medicine, is currently being used more widely than ever before in Western countries [19]. Along with herbal medicines, other herbal products such as cosmetics, fragrances, teas, health foods and nutraceuticals are equally popular and constitute a large proportion of global herbal business.

Although about two thirds of the world population uses herbal medicines there are serious doubts about their safety and effectiveness. For example, in the USA about 20,000 herbal products are available, but of the ten most used herbs only four are likely to be effective [20]. Thus, herbal medicines suffer from a range of shortcomings, including insufficient and unacceptable evidence of safety, efficacy and standardization. These shortcomings are played well by the promoters of modern medicine reducing the confidence level of the users of herbal medicine, especially of the elite in the developing as well as developed countries. Increased use of herbal medicine may be attributed to a) adverse side effects of synthetic medicine, b) availability of more powerful and reliable techniques for extraction, isolation and analysis, and c) increase in the capability of using these techniques in countries rich in medicinal plants. The last point has to be strongly pursued in tropical countries to bring the international trade of herbal products in their favor by increasing their scientific capability even further.

Consideration of the growing importance of herbal medicine and other herbal preparations, concerns about the safety and claimed efficacy of many herbal products, and lack of proper scientific evaluation resulted in the International Union of Pure and Applied Chemistry (IUPAC) supporting a project with the objective of preparing protocols on safety, efficacy, standardization and documentation of herbal medicine. The protocols have been published in *Pure and Applied Chemistry* as an IUPAC Technical Report [21]. In this document, various aspects of the science of herbal medicine in modern times have been compiled in one place and it is expected to advance significantly the scope of scientific assessment of herbal products prepared following certain standards. With the target of utilizing the protocols in developing herbal medicine for better healthcare, especially in the developing countries, establishment of an International Centre for Natural Product Research (ICNPR) has been initiated in Dhaka, Bangladesh.

Adverse effects of modern medicine have been studied. In one study in 1994 [22], it was shown that 106,000 people died in the US and 2.2 million were seriously injured by adverse effects of pharmaceuticals. Although no such exhaustive study is available for herbal medicine, contaminated, unregulated and inappropriate use of herbal medicine may have serious consequences.

The toxic effects of herbal preparations may be attributed to a) inherent toxicity of plant constituents, b) manufacturing malpractices, c) misidentification of plants, and d) accidental or intentional contamination. Based on human experience in various cultures, it may be safely assumed that toxic plant ingredients have already been eliminated and the recent reports of toxicity are mainly due to misidentification of plants and accidental or intentional contamination. Unintentional contaminants may include microorganisms, microbial toxins, pesticides, fumigation agents, radioactivity and presence of toxic metal compounds [23, 24]. Intentional contaminants are usually synthetic drugs [25]. Inadvertent substitution due to similarity in appearance and difficulty in nomenclature has been reported [26]. Intentional substitution for reducing cost is also known.

Adverse effects associated with herbal medicine were first reported for medicinal plants of the Asteraceae family, the genera *Hypericum* and *Aristolochia*, and Kava-Kava. Many cases of inadvertent or deliberate substitution are cited in the literature. Examples of substitution resulting in adverse effects include reported cases of hepatitis with Jin Bu Huan [27], renal fibrosis due to *Aristolochia fangchi* [28] and podophyllin poisoning due to *Podophyllum emodi* [29]. Jin Bu Huan is used for pain relief and insomnia [27]. In Belgium 70 people required either renal transplant or dialysis for interstitial fibrosis of the kidney after taking a herbal preparation as a slimming agent [30]. The preparation was known to contain *Stephania tetrandia* and *Magnolia officinalis*. However, it was later found to contain aristolochic acid from *Aristolochia fangchi*. Aristolochic acid is nephrotoxic in animals and humans [31].

Generally speaking, there are no legislative criteria for use in regulating herbal products, including herbal medicine. They remain largely unregulated as drugs and different countries use various regulations of their own in most cases without any proper scientific validation. Some countries follow WHO guidelines [32]. Herbal products range from phytomedicines, food and dietary supplements, cosmetics and nutraceuticals where therapeutic claims are not made. However, herbal medicines and folkloric knowledge are considered interlinked and, therefore, some countries justify less stringent regulations. In the USA, herbal products are marketed as food supplements. Specific health claims need stringent FDA approval. Europe is more liberal in this respect, but it uses various regulations for the use of herbal medicine. Directive 91/507/EEC gives details of quality, safety and efficacy, European Directive 2004/24/EC of 31 March 2004 and United Kingdom Statutory Instrument No. 2750 are some of the examples.

There is hardly any monitoring or surveillance system in place in most of the developing countries where herbal medicine is extensively used. Therefore, regulations and proper legislation must be introduced to ensure that required standards of safety and efficacy are met. A balance between herbal industry and regulation is needed to protect public health. For the evaluation of herbal products several steps are to be followed [33, 34] such as a) identity of ingredients, b) history of use, c) any reported adverse reaction, d) toxicity (if any) and e) any clinical trial data.

Major chemical constituents of a herbal preparation may be analyzed by chemical fingerprinting [35]. However, analysis alone is unlikely to reveal the contributions of constituents to toxicity. Therefore, one or more of the common techniques are to be used. Even then, the dose chosen is very important. *In vitro* methods may be used on live animal parts, whereas *in vivo* techniques can be used on live animals as such. In *in vivo* techniques, better results are obtained when vital organs are analyzed for adverse effects after feeding the animal (usually rats) for a reasonable length of time (3-6 weeks). *In vivo* techniques, however, need ethical

clearance, which is not easy to obtain in western countries. Cell-line techniques reduce the ethical requirements. Micro-array and other modern techniques are also available for assessing toxicity. As herbal products are complex mixtures, use of conventional pharmacological approaches remains a major challenge. Analysis of contaminants like toxins, toxic metals, microorganisms, and bacteria or viruses are also required to get a complete picture of the risk of using a herbal product.

Risk assessment and management depends on the analytical methods discussed above, along with the study of bio-availability and bio-accumulation. In assessing, two groups of people are to be considered, workers preparing and handling the herbal medicine and those who are using them. Presently accepted procedures in Australia [36] and by the USEPA [37] enable the formalized approach of risk assessment to be applied when required.

The age-old wisdom of the use of herbal remedies does not necessarily guarantee that the product in question is efficacious with reasonable specificity. Herbal medicine usually takes an overall view of well-being of an individual, whereas modern pharmaceuticals take a direct approach for a certain disease condition. By taking the best part of both systems, an integrated approach may be taken to design practical indicators and methodology for testing the efficacy of herbal medicine. Until then, the currently used clinical, laboratory and diagnostic methodologies for conventional pharmaceuticals are to be utilized for assessing the efficacy of herbal medicine. The question remains whether the use of laboratory and clinical methods of efficacy are sufficient for assessing the efficacy of a herbal medicine whose philosophical base depends on socio-economic, cultural and psychological variables, which should be integrated with the clinical and diagnostic parameters. Under the circumstances, the flexibility inherent in modern scientific methods is to be utilized for conducting studies on herbal medicine. The study design will have to be sound regarding evidence, subject selection, randomization, mode of treatment, controlling compounding variables and reporting of results [38]. Following an integrated approach, the efficacy of herbal medicine may be tested by applying a) anecdotal reports, b) case reports, c) case series, and d) randomized clinical trials.

Standardization

Normally, anecdotal reports are not considered in conventional medicine. However, these are important components of the efficacy assessment of herbal medicine because the knowledge base is scattered around with practitioners, tribes, families and communities in distant locations. Organization of these anecdotal reports in a well designed way may provide useful data on the efficacy of a large group of herbal medical agents. Case reports are very useful in studying efficacy and toxicity of many drugs [39] and can represent the first clues in the identification of new diseases, new interventions or previously unknown adverse effects. Case reports can be retrospective (very difficult to obtain as most herbal medicine practitioners do not keep records) or prospective (may be more easily achieved by coordinating with a selected number of herbal practitioners). Case series are a collection of individual case reports, organized to explore a particular association. Randomized clinical trials (with double-blind ones being the gold standard) are the ultimate measure of efficacy in conventional medicine, but can hardly be utilized in the case of herbal drugs [40]. These trials are inherently interventional and ethical questions are strong until sufficient evidence about the efficacy and safety in animals are ascertained for the concerned herbal product. Socio-cultural factors, beliefs and placebo effects make the matter even more complicated. It is also to be kept in mind that the use of testing methodologies used for conventional medicine on herbal drugs may offset the low- cost health benefit enjoyed by the majority of the population who are most dependent on herbal medicine. In the context of the constraints discussed above, an increased emphasis may be given to case reports and case series approaches in assessing the efficacy of herbal medicine. Retrospective data may be difficult to compile, but prospective data collection will be easy to implement by utilizing herbal medicine practitioners. Scientifically analyzed data from case

series may provide sufficient scientific and ethical validity. Yet, it may require a paradigm shift in the understanding of drug evaluation as underscored by WHO by taking into consideration ethnobotanical claims, anecdotal information, laboratory studies and observational studies.

Synthetic drugs are prepared following strict standard operating procedures and each batch may be considered of the same quality. However, herbal medicine producers hardly follow any such regulated procedures, although there are some standard procedures available mainly in Asia. Moreover, there are many variables in producing a herbal drug by using single or multiple plant materials. These variables include the identity of the plants, their parts, origin, substitution, extraction procedure and climatic condition of growing the plants. Thus, herbal product studies cannot be considered scientifically valid if the product has not been authenticated and characterized in order to ensure reproducibility. Variations in marker compounds are often found in quantitative studies. Considering the growing use of herbal medicine there is an urgent need and scientific requirement to conduct in-depth research into phytomedicine [41]. Development of authentic analytical methods that can reliably profile the phytochemical composition of herbal products is a major challenge. Strong commitment from the stakeholders is necessary to safeguard the industry and the consumers, keeping in mind the resurgent interest and market in herbal medicine.

Fingerprinting

Like conventional synthetic drugs, a quality assurance program has to be in place for herbal medicine. The job is complicated as the herbal product contains many compounds and only a few may be pharmacologically active. The European Union categorizes the compounds as those having proven efficacy, those likely to have activity and those which are inactive. Standardization of herbal medicines may be made by following the presence of the active compounds or any compound present in easily identifiable quantity, but which may or may not have biological activity. These compounds are known as marker compounds [42]. In the EU [43] and USA [44], for certification of botanical drugs and herbal preparations, the analyses must be performed by following the respective pharmacopoeias. The analysis of the drugs, however,

depends on the method of processing, especially the extraction and analytical methods used. Of course, for any kind of quality control of a herbal medicine, the identity of the plant(s) has to be ascertained first. Extraction and chemical analysis comes next. Another compounding factor is the use of various unregulated coloring and binding materials, and preservatives. Although refluxing and Soxhlet extraction were common in earlier days, in recent times cold extraction of plant materials are commonly used [45, 46]; the solvent used is normally ethanol or water or a mixture thereof. Hot extraction, however, is practiced by many herbal product manufacturers. For improved extraction, newer methods include microwave assisted extraction [47], subcritical water extraction [48], and accelerated solvent extraction [49].

The extract obtained by any method will be a complex mixture of many compounds. Various chromatographic methods are used to separate individual compounds, followed by biological screening. TLC, HPLC and NMR are often used to record fingerprints of chemical constituents. NMR, LC-MS-MS are usually sufficient to identify and characterize isolated compounds [50]. Very recently, other high resolution techniques have come into use in some advanced laboratories for validating the identity of individual compounds. AAS is normally utilized to determine metallic elements. Use of methods based on inductively coupled plasma has made identification of metallic compounds easier. The constraint is that in most developing countries, the costs of analysis and standardization are still too high. Instruments, infrastructure, expertise and human resources are impediments in standardization technology. New thoughts are to be focused on the concept of therapeutic validation and standardization of herbal medicine to address the issues, putting a major challenge to the scientific community and social and political leaders.

The complex mixture of an extract from an herbal product may contain organic compounds like fatty acids, sterols, alkaloids, flavonoids, saponins, glycosides, tannins, lignans, terpenes, peptides and carbohydrates, and determining the bioactive component(s) is very difficult. Moreover, pharmacological experiments with single isolated compounds versus the original extract or extract fractions have confirmed that phenolic compounds and terpenoids may exert polyvalent pharmacological effects [51]. This may explain the synergistic effect and better activity of an extract than a single isolated compound. This concept that a whole or partially purified extract of a plant offers advantages over a single isolated ingredient underpins the philosophy of herbal medicine. Evidence to support synergistic and polyfunctional effects have been reviewed [52]. A new challenge is then towards understanding the effects of complex mixtures on molecular and biochemical processes in health and disease.

Herbal medical knowledge is scattered around in communities, families, tribes and local practitioners. With the effect of modernization and globalization much of this knowledge may quickly be lost unless documented early and made accessible to all the people. Established systems of herbal medicine, such as Ayurveda, Unani and TCM have well documented books and pharmacopoeias. However, the situation elsewhere is not similarly documented. Moreover, the drug dispensed by an indigenous medical practitioner may often not follow the available protocol. Variation in the raw materials used is also almost bound to happen. Therefore, chemical standardization is the way forward, if herbal remedies are to be widely used for healthcare. Chemistry and basic bioassay of medicinal plants are available in scientific journals, but are hardly compiled for easy reference. This information may be used for quality control, standardization and development of a new Western drug. There is much less information on herbal dietary supplements and nutraceuticals, which are accessed by large sections of the population of developed countries. A pharmacopoeia-like 'nutracopoeia' should be produced by the producers of such products giving details of preparation, active constituents, efficacy status, chemical and clinical data (if any) to strengthen their claims, which often have no real basis. The IUPAC Technical Report [21] mentioned earlier, outlines formats for documenting single plants and composite herbal medicine.

The global craving for herbal products, often coming from developing countries, has serious implication for the survival of many plant species and a large scale program of cultivation should be initiated to replace herbal products, which are unsustainably collected at the behest of manufacturers and exporters of herbal medicine. Conservation and cultivation methods must be developed and the information documented.

Intellectual property rights

Presently, a number of databases, mostly on single plants, are available, but many of them are not freely accessible and some are not publicly available due to intellectual property concerns. Some databases are accessible and contain much information about medicinal plant materials and in some cases composite herbal drugs as such. A commercial database (www.cintcm.com/index.htm) contains more than 500,000 records of TCM. Access may be bought from the Indian CSIR database, namely Traditional Knowledge Digital Library (TKDL), which is a repository of Ayurvedic, Unani and Siddha medicine. AGRICOLA (USDA), MICROMEDEX (www.micromedex.com/products/altmed-dex), and CRISP (www.crisp.cit.nih.gov) are general databases that contain information about individual plants and some herbal medicines. NAPRALERT, maintained by the College of Pharmacy, University of Illinois at Chicago, contains information on ethnomedicine and Natural Products published in journals. European Scientific Co-operative on Phytotherapy (ESCOP) maintains a database which also includes adverse effects on the use of herbal medicine. The requirement is to establish a central digital document database which is regularly updated and easily accessed by all beneficiaries, producers and stakeholders and which contains information on each approved medicinal plant or herbal medicine.

One of the main problems of developing herbal medicine acceptable to modern scientific communities and societies is the secretiveness of the traditional medical knowledge held by individuals, families, tribes and communities. They fear that their knowledge will be stolen and used for financial gain. They may be convinced by demonstrating that their plant materials may be improved by biotechnology. Incidentally, most of the unevaluated biological resources are in the developing countries and their traditional knowledge is being rapidly lost due to overexploitation and life style changes. The Convention on Biological Diversity (CBD) in 1992 provided an incentive to developing countries for the sustainable use of biodiversity. Although most countries (180) are members of CBD, very few have introduced legislation in conformity with the convention and only a handful of useful agreement has emerged. World Intellectual Property Organization (WIPO) and World Trade Organization have created a problem in the implementation of CBD. WTO's Trade Related Intellectual Property Rights (TRIPS) does not permit the patenting of herbal medicines as much of the knowledge involved is not novel and in the public domain. However, a few patents having new composition and processes of herbal drugs have been achieved [53-55]. Only plants and compounds with new biological activities or the biological activity itself are considered patentable. A general agreement on the protection of traditional knowledge and necessary changes to TRIPS should be attempted without any loss of time.

Conclusion

Herbal medicine plays a significant role in healthcare, offering a cost-effective and often culturally accepted alternative or supplement to traditional medicine. While promising, it's crucial to use herbal remedies with caution and under the guidance of a qualified healthcare professional due to potential interactions, side effects, and the need for proper standardization and dosage. Herbal medicinal products are the primary healthcare source for the large population living in developing countries. India has a rich traditional system of medicine. Therapeutic treatments like Ayurveda, Unani, Homeopathy, Sidha, etc., mostly use herbs.

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