

Medicinal plants and their validation challenges in traditional Egyptian medicine

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ABSTRACT

Remediation with medicinal herbal drugs is used in almost all cultures. Recently, herbal medicine has gained growing popularity in the current medical practice. The herbal products are considered available, acceptable, cheap, and safe products; thus, there is confidence in using these products. So, the quality, efficiency, and safety assurance of plant medicines became critical issues in both developed and developing countries. By standardizing the plant-derived drugs, a new era of a future remedy and healthcare system could be created. In order to keep this knowledge, historical records of medicinal plants are needed to be used for the benefit of humanity before their extinction forever. Egypt is characterized by a unique aromatic and medicinal flora that is required in the global market, which could increase the Egyptian exports. But there are several obstacles to the competition of Egyptian aromatic plants in the world market. Therefore, this review describes the historical use of medicinal plants throughout the published data using online search engines. The recent challenges in the quality, efficacy, authenticity, toxicity, and consistency of medicinal plants will be discussed. Also, this review aims to explore the economic situation and challenges of the herbal medicine industry in Egypt.

INTRODUCTION

Nature is the prominent source of symbiosis living phenomena. Traditional medicine mainly relies on ingredients extracted from natural resources such as herbs and animals, which have been used for the treatment of illnesses all over the world for a long time (Firenzuoli and Gori, 2007; Garg *et al.*, 2021). Remediation utilizing traditional medicines is diminished within the developed countries. While almost 75%–80% of developing countries' populaces rely on traditional medication (Kamboj, 2000; Maroyi, 2013; Ozioma and Chinwe, 2019; WHO, 1995), the demand for traditional medicine in developing countries is increasing as the population grows especially plant-derived medicines. Interest in herbal medicine among pharmaceutical companies has also increased in developed countries (Hostettmann *et al.*, 2000). On the other hand, the minor side effects of the

medicinal plants and the increasing prices of allopathic drugs, in addition to their failure to treat some diseases, led to the increase in traditional medicine consumption in the treatment of illness (Basgel and Erdemoglu, 2006).

Egyptian traditional medicine is characterized by a mixture that combines Arabic, Islamic, and African cultures. But, in the last decades, the use of herbal drugs in treatment has declined. Herbal therapeutics is practiced by a folk healer called "Attareens." They are unqualified people, but they have gained their experience from the Arab heritage, such as Avicenna and Dawood's ticket (Haggag, 2014). The author mentioned that the physicians, especially new graduates, neglect the description of herbal drugs to their patients. Physicians do not trust herbal drugs because they did not study their importance in their faculties. Actually, almost all medicinal faculties in Egypt lack courses that explain the value of herbal medicines. Therefore, doctors are not mindful of the significance of traditional therapy and its utilization by the Attareens. Also, the progress in organic chemistry resulted in the synthesis of numerous organic pharmacologically active compounds. The therapy with these compounds was encouraged

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by the ease of their laboratory synthesis in abundant quantities. In addition, the marketing promotions to these compounds by the producers play a crucial role in their use.

Now in Egypt, as in all over the world, people have become aware of the efficiency and safety of the herbal drug besides their lower cost. Now great efforts are made to study the Egyptian flora and discover new species. The studies include the most suitable pharmaceutical forms to be complementary to conventional drugs (not alternative medicines). The current strategy is to discover a compatible herbal drug with conventional medicine to make effective, safe, available, and affordable drugs (Abdel-Azim *et al.*, 2011). Thus, this review summarizes and discusses the historical background, development, recent challenges, and future perspective of using herbal plants and their constituents. The obtained data reveal that Egyptian flora possesses a wide variety of traditional medicinal uses. Several active ingredients, for example, phenols, flavonoids, tannins, alkaloids, terpenes, saponins, steroids, and volatile oils, have been recognized. Although the activities of many herbal drugs in several traditional remediations have been evidenced, further investigation and validation of many other toxicological and biological studies are needed.

HISTORY OF TRADITIONAL MEDICINE AND HERITAGE

Herbal medicine therapy seems to be universal in successive civilizations, since its use dates back nearly 600 centuries in ancient Babylon, 50 centuries in Egypt and China, and 2.5 centuries in Central Asia and Greece. (Ang-Lee *et al.*, 2001; Qazi and Molvi, 2016). The oldest book about herbal medicine in the world, “*The Devine Farmer’s Classic of Herbalism*,” was written in China 2000 years ago (Wachtel-Galor S and Benzie, 2011). However, the herbal systems, practices, and philosophy vary by the culture in which it first evolved (WHO, 2005). Chinese have their special herbal system recognized as the Traditional Chinese medicine (Wnag and Li, 2005). In India, *Ayurveda*, a healthcare system, has long been followed for over 50 centuries. Its *materia medica* describes over 1,500 herbal plants and 10,000 drug formulations (Goyal *et al.*, 2012). Also, the Japanese herbal system, *Kampo medicine*, extended to 1,500 years with approximately 148 drug formulations (Watanabe *et al.*, 2011).

The Arabs were subjected to Greek civilization for a long time before Islam and learned the hypothesis and practice of healing. Through the ages, the Persian Ibn-Sina, known as Avicenna, has been a great name in the history of medicine. Traditional medicine first came to the Persian Gulf through his writings (Moe *et al.*, 2014). There are several Persian references for finding effective medicinal plants such as *Canon*, *Al-Hawi fi al-tibb*, and *Tohfah al-Muaminin*. The *Canon* book was authorized by Ibn-Sina and considered the reference of medicine for nearly 600 years (Ziaei *et al.*, 2016). The second volume of the “*Canon*” book deals with medicinal plants’ usage (Tashani and Johnson, 2010).

The book “*Al-Hawi fi al-tibb*” was written by Abu Bakr Muhammad ibn Zakariyya al-Razi based on his personal memoirs and notes. *Al-Hawi* is a genius work (23-volume series) that includes 900 case studies about disease treatments, with an emphasis on natural folk medicine and healing applications. Also,

Al-Hawi contains abstracts from preceding authors respecting various diseases and therapies (Savage-Smith, 1994). This book was translated into Latin in the 13th century and possessed a considerable influence over the European therapy medicament (Moe *et al.*, 2014). The book “*Tohfah al-Muaminin*” is a comprehensive pharmacopeia of medicines written by the great pharmacist Hakim Muamin in the 16th century (Al-rhazes, 2005). This book is an important reference among the cohorts of folk medicine.

Traditional medicine has been used since the ancient ages for treating human illness in Egypt (Abdel-Azim *et al.*, 2011; Haggag, 2014). Herbal medicine represents the main type of traditional medicine where the ancient Egyptians were experienced in medicinal herbs and their usefulness in the treatment of diseases. The first recorded prescriptions of herbal medicine were found in ancient Egyptian tombs (Mostafa and Singab, 2018). Moreover, the symbols on the temples’ walls and writing in the papyri indicated that the Pharos was treated with several herbal medicines for the same purposes in a similar way as they are used today. Also, they applied their medicaments obtained from plant organs such as leaves, roots, fruits, flowers, rhizome, seed, and oils in the form of paste, cream, suppositories, pill, powder, and ointment (Dagmar, 2006; Shahat *et al.*, 2001). It is enough to mention the amazing vague miracle of embalming. Nowadays, with tremendous scientific development, the mystery of embalming is still unknown. This indicated that the Egyptian herbal drugs were used on a scientific basis by a qualified herbalist who had the extensive knowledge to formulate the required drugs.

HERBAL MEDICINES

Herbal medicines are the prominent type of folk medicines, and in some cases, they are synonymous. Although they represent the oldest type of traditional medicine, they are still the widespread system of healthcare all over the world now. Herbal medicines are defined by World Health Organization (2000) as the herbs, herbal materials, herbal preparations, or finished herbal products in which the medicinally active ingredients obtained from aerial or underground parts of plants are intended to be used as therapeutics for human benefits and sometimes animal (Bent, 2008). Herbal drugs could include conventional excipients, naturally organic and inorganic compounds of nonvegetarian origin as well as vitamins and minerals in addition to the plant-based active ingredients. Herbal medicinal products may contain vitamins and minerals as supplementary substances. However, products to which synthetic compounds and/or isolated substances from herbal materials (Atropine and Diosgenin) have been added are not considered to be herbal medicinal products (Calixto, 2000).

The plants containing components that can be exploited for medicinal uses or potentially used for the synthesis of medicines are generally recognized as medicinal plants. These plants that have been exploited in folk healing for long times without scientific evidence to their efficiency are recognized as crude drugs of natural or organic origins. These plants could be further classified as “organized drugs” if they are originated in cellular plant parts such as roots, leaves, and steams and “unorganized

drugs” if they are extracted from acellular parts of plants like oil, gums, gel, balsam, and exudate (Ozioma and Chinwe, 2019).

Plant parts used as herbal medicines are as follows (Ozioma and Chinwe, 2019):

- Roots: solid, fibrous, or fleshy parts of plant roots, for example, ginseng stinging nettle devil's claw roots.
- Bulbs: the structure that grows underground, for example, onions and garlic.
- Rhizome: the fleshy stems that grow horizontally underground while their leaves grow above the ground, for example, ginger, spear grass, and turmeric.
- Tubers: the swollen fleshy underground structures, for example, potatoes and yams.
- Bark: the outer layers that protect trunks or stems of the trees, for example, quinine bark, oak bark, pepper bark, and willow bark.
- Leave, stem, twigs, and buds of plants, shrubs, and trees, for example, maidenhair tree.
- Flower parts of several plants that have medicinal properties, for example, pyrethrum, saffron, santonica, clove, and chamomile.
- Seeds: seeds of several plants that have medicinal properties, for example, bitter almond, black mustard, cardamom, ispaghula, kaladana, linseed, and nutmeg.
- Fruits: fruits of several plants that have medicinal properties, for example, amla, anise, bael, bahera, bitter orange, capsicum, caraway, cardamom, colocynth, coriander, cumin, dill, fennel, star anise, and tamarind.
- Exudates, gum, and nectar parts which are formed by plants as self-defense agents against insects and animals, for example, acacia, guar gum, Indian gum, sterculia, and tra-gacanth.

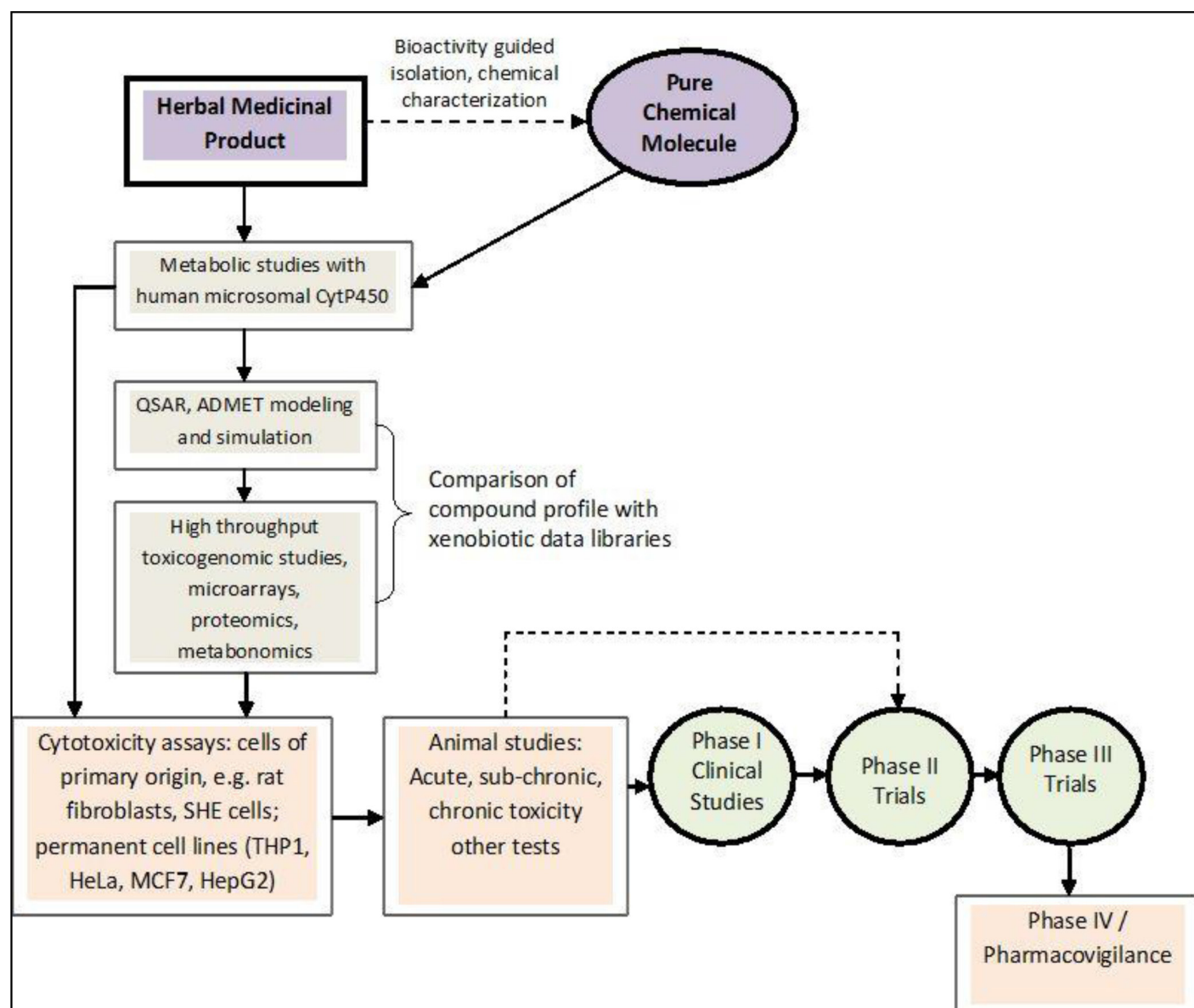


Figure 1. Schematic processes involved in evaluating and establishing the toxicity of medicinal herbs. The broken arrow indicates that this process for some herbal medicines may not always be necessary (source: Ifeoma and Oluwakanyinsola, 2013).

PROSPECTIVE CHALLENGES OF HERBAL MEDICINES USE

Toxicity and safety aspects

Unlike allopathic medicines that include single or few standardized compounds, herbal medicine of a single plant contains hundreds of compounds that require a long time to be isolated and toxicologically assessed (WHO, 2005). In some countries, herbal products could be marketed without toxicological assessment. Moreover, these countries lack the ability to achieve such assessments (Ekor, 2014; Thakkar *et al.*, 2020). Consequently, the lack of these aspects could expose the consumers to prospective hazardous and side effects due to the presence of toxic compounds (George, 2011; Mensah *et al.*, 2019).

Lack of quality control

Quality control in the modern system of drugs production is of critical importance in order to justify its acceptability. Quality aspects of medicines include purity, identity, and safety assurance, in addition to efficiency of course. As a concern, the quality of herbal sources is a critical point facing herbal drug marketing (Verma and Singh, 2008). But, there are several challenging aspects involved in the quality standardization of medicinal and aromatic plants. These challenges include the temperature and light exposure, nutrients and water availability, and time and method of harvesting as well as postharvesting treatments, that is, drying, packing, storage, and transportation (Kunle *et al.*, 2012).

Lack of governmental legislation

Herbal drugs can be marketed for maintaining, simulative, supportive, and promoting supplementary formulations healthcare and wellbeing in many countries. These formulations should have authenticity certificates labeled properly indicating the involved compounds and their intended medicinal purpose within humans according to Act 101 of 1965 and its amendments (2002) (Ndhkala *et al.*, 2011). These labels evidenced the effectiveness, safety, and quality of such herbal medicines, thereby enhancing the concerns of consumer confidence in these herbal products (Ekor, 2014).

Scientific and clinical assessment

Unfortunately, not all naturally originated ingredients are safe. Some of the drugs used in traditional medicine proved to be harmful to some vital organs of the body. Therefore, quality, safety, and efficiency assurance of herbal products by researchers, regulatory authorities, and manufacturers must be achieved using comprehensive clinical trials and vital scientific methodologies, as illustrated in Figure 1 (Rana and Rana, 2014). The safety assessment of any medicinal compounds considers both the nature and significance of the adversary effects. WHO (2004) issued guidelines for assessing the safety of herbal medicine, which was followed by Food and Drug Administration (FDA), International Conference on Harmonization (ICH), and United States Pharmacopeia (USPC); these guidelines include the following:

- Clear drug botanical origin identification including extensive description of the basic botanical features, whether in the crude or processed forms.
- Complete ingredients identification through comprehensive chemical analysis, especially the pharmacologically active constituents using reliable estimating methods.
- Safety pharmacological comprehensive studies evaluating both acute and chronic toxicity.
- Efficiency confirmative clinical studies required for a drug. However, the long-run use of old drugs in several countries for the same disease treatment is good evidence of its efficiency.

DRUG DISCOVERY OF NATURAL COMPOUNDS

Natural drug discovery is a challenging task that describes the phytochemical analysis, characterization, and pharmacological investigation. It focuses on the process of finding and discovering new and effective drug compounds (Koparde *et al.*, 2019). Various strategies for natural drugs discovery can be seen in Figure 2. Furthermore, herbal drug discovery could be classified into three stages, namely, predrug stage, quasidrug stage, and full-drug stage (Pan *et al.*, 2013). Generally, the discovery processes of natural drugs could be classified into two major categories (Jamshidi *et al.*, 2018).

Traditional processes

Figure 3 summarizes the traditional drug discovery process using the guided bioassay steps. The direct isolation process could lead to the isolation of several natural ingredients suitable for biological activity measurements. However, the discovery of herbal drugs and their identification was a difficult and lengthy process with a low rate of success and huge capital investment due to the complexity of the compounds (Barden and Weaver, 2010; Sarker and Nahar, 2013). Nowadays, the bioassay of herbal compounds is significantly improved by the innovation of precise methods and accurate techniques, that is, high-performance liquid chromatography (HPLC), liquid chromatography–mass spectrometry (LC/MS), gas chromatography–mass spectrometry (GC/MS), and nuclear magnetic resonance (NMR). These recent techniques are promising tools for the classification of compounds that are found in minor quantities in their origin (Koparde *et al.*, 2019; Schroeder and Gronquist, 2006).

Modern processes

In modern pharmaceutical discovery research, new techniques, that is, combinatorial chemistry, HTS, bioinformatics, proteomics, and genomics, are widely emerging. These include molecular diversity, compound-library design, protein 3D structures, NMR-based screening, Three-dimensional quantitative structure-activity relationships (3D-QSAR) in modern drug design, physicochemical concepts, and computer-aided drug design using different software, its prediction of drug toxicity, and metabolism (Thomford *et al.*, 2018). For instance, in the high-throughput screening (HTS) method, several molecules can be investigated in many quick assessments with minimum quantities of compounds. In HTS programs, a library of natural compounds should be established. These advanced techniques significantly improved the isolation and identification of natural products and

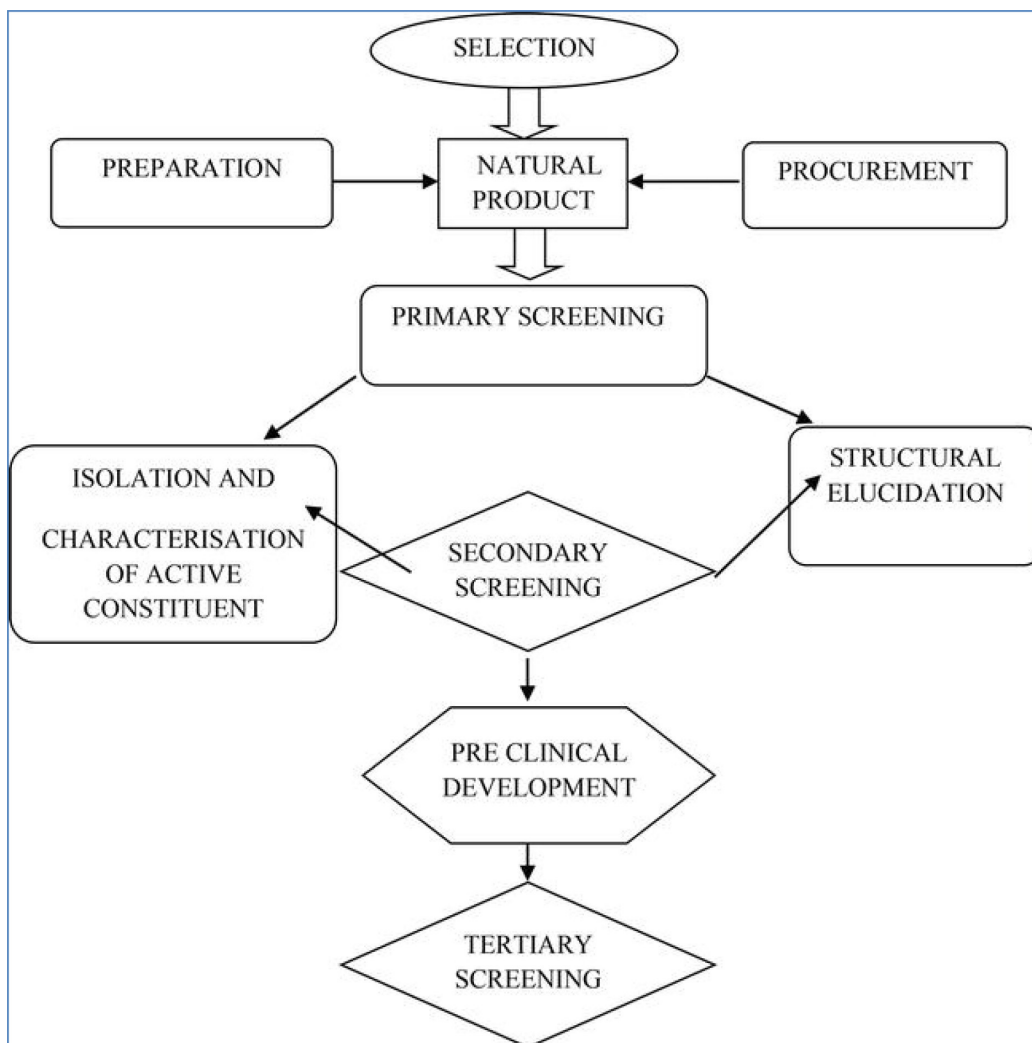


Figure 2. Various strategies for the discovery of drugs from natural resources (source: Koparde *et al.*, 2019).

consequently enabled scientists to develop novel drug formulations (Fig. 4) (Sarker and Nahar, 2013).

HERBAL MEDICINE IN EGYPT

The Egyptian geographic position has made it a core of world trade since the beginning of creation. Egypt can be a pivot point in the field of herbal medicines in the Mediterranean and Arabia regions. Also, Egypt has wide areas of virgin land, free of contaminants and pollution, with its wide variety of climatic conditions that will ensure the high quality required for the products. Besides, Egypt owns the largest groups of experienced scientists able to deal with modern techniques. Egypt already has a strong infrastructure of low-cost factories of several other industries in the world market (Abdel-Azim *et al.*, 2011). Besides, the Egyptian flora has more than 2,000 species of medicinal plants dispersed across the Egyptian locations. These locations vary in the edaphic and prevailing climatic and other ecological circumstances that encourage the growth of miscellaneous herbal species. Also, several herbal plants have been successfully adapted under the Egyptian condition (Shams *et al.*, 2009).

COMMON MEDICINAL PLANTS IN EGYPT

Although many reports have clarified the Egyptian herbal plant for a long time, the comprehensive reporting of the Egyptian flora was prepared by Tackholm (1974). This report was revised, updated, and published in four series by Boulos (1999, 2000, 2002, 2005). This report indicated that herbal plants were and still are extensively used by the Egyptians for several ailments therapy. This encouraged the scientists to reconsider the old formulations (Abdel-Azim, 1998; Hamed *et al.*, 2007; Mahmoud *et al.*, 2007). Also, there is a general trend towards traditional therapy; consequently, herbal plants are proving to be unconventional drugs. Furthermore, numerous herbal medications are still used in folk medicine, and such products are distributed by herbal merchants all around Egypt.

For example, fennel, chamomile, basil, anise, peppermint (essential oils and aroma crops) are planted in Egypt with a very good reputation in the world trade. But the recent production characteristics of such products hinder their exportation due to the presence of improper contaminants levels and, in some cases, the presence of heavy metals, pesticides, and organic

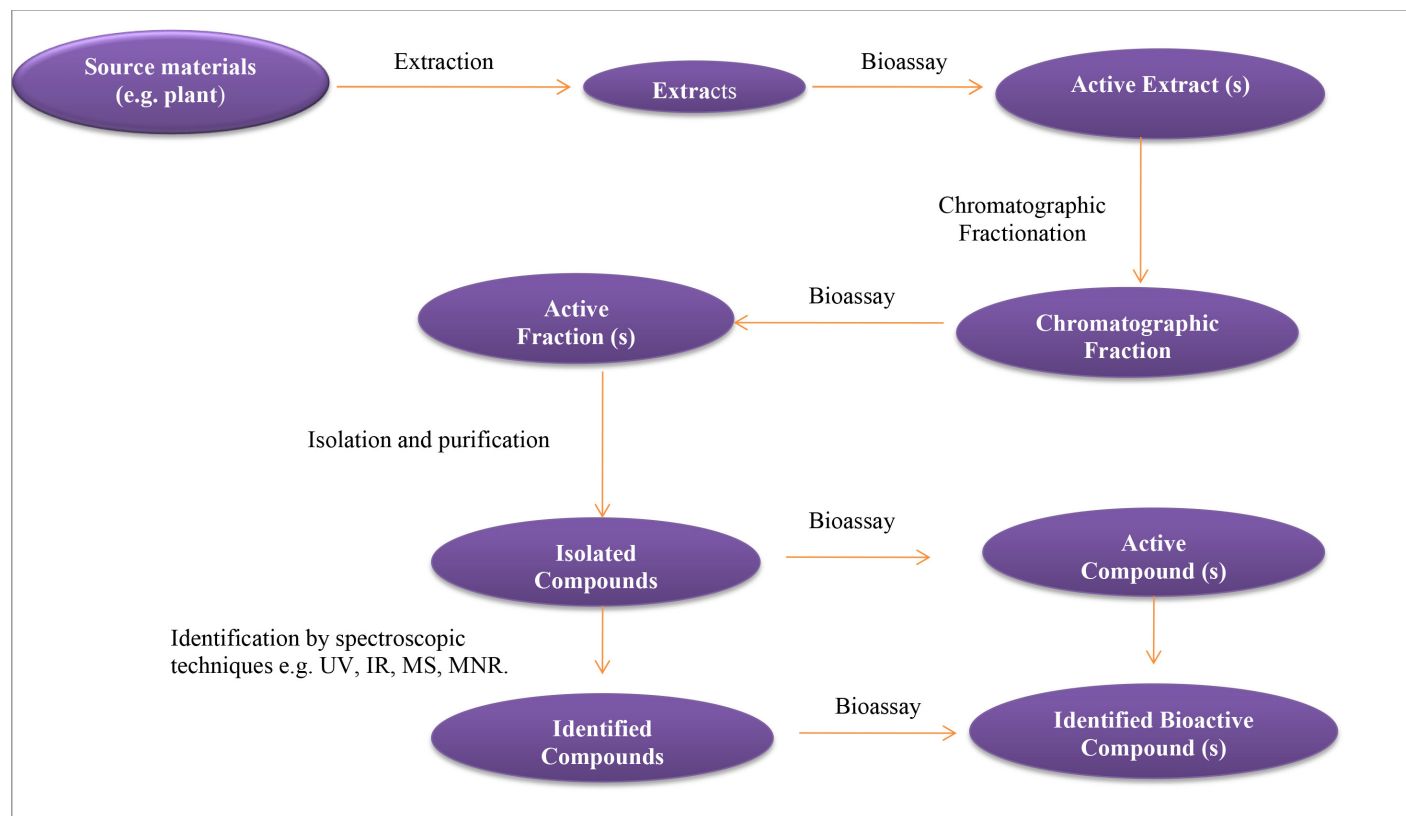


Figure 3. The traditional process of discovering natural drugs (source: Jamshidi *et al.*, 2018).

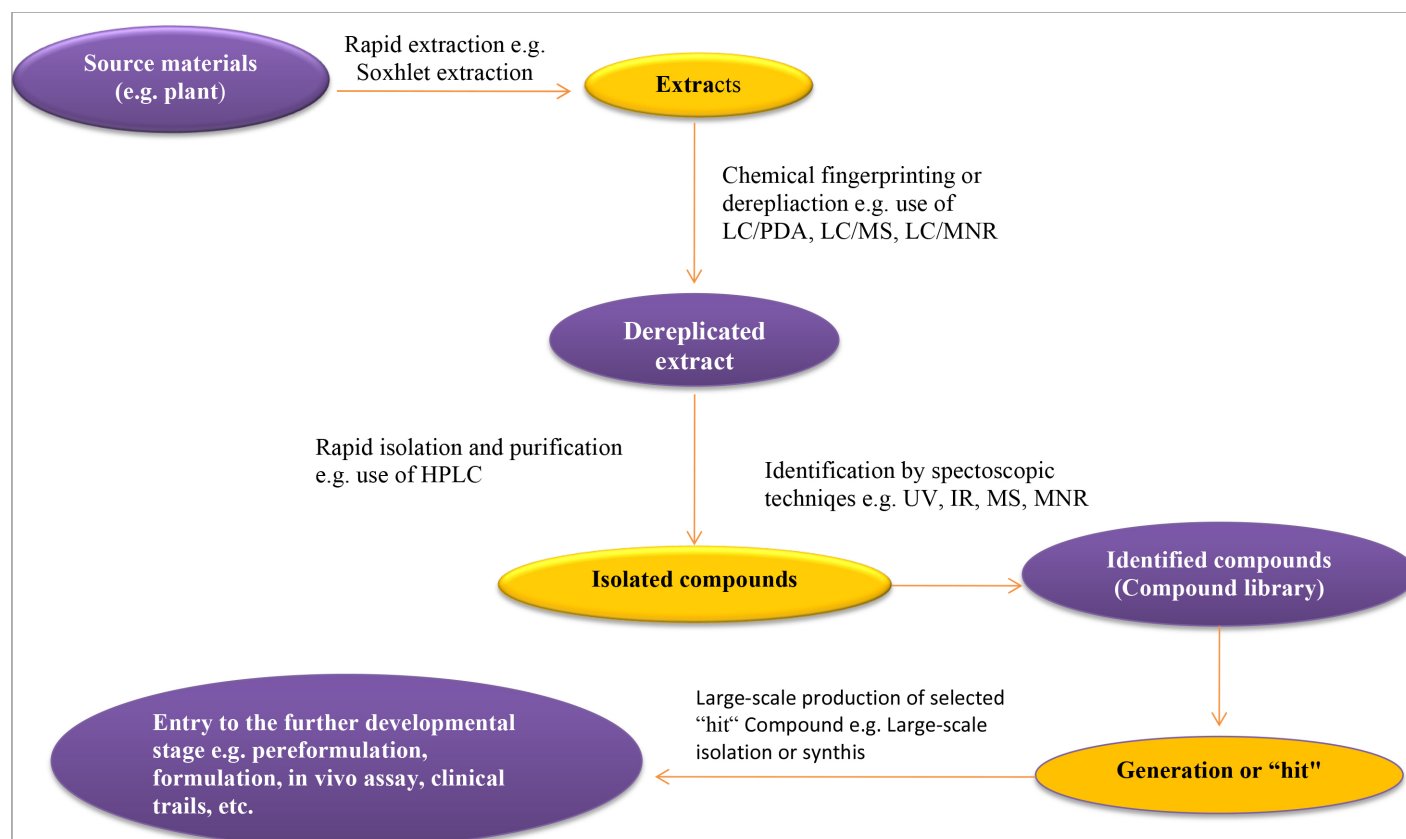


Figure 4. The modern process of discovering natural drugs (source: Jamshidi *et al.*, 2018).

Table 1. Validated medicinal plants and their medicinal uses.

Name	Active compounds	Traditional use and validation	Used part	Dosage
<i>Artemisia annua</i> L. Family: Compositae Common name: wormwood, annual mugwort, and sweet annie	Artemisinin	Antimalaria, hemorrhoids, and stomach complaints (Yimer and Sahu, 2016)	Herb	Infusion of water soaked dried herb (1.5–3 g/250 ml for 15 minutes, 250 ml 4×/day for 5 days/women or 7 days/men) (Yarnell, 2014)
<i>Allium sativum</i> Family: Amaryllidaceae Common name: garlic	Alliin, allicin, ajoene, amino acids, and selenium	Coughs, chronic bronchitis, bronchitic asthma, respiratory catarrh, influenza, and cold (Barnes et al., 2007)	Pulbs	Adults: 4 g raw garlic/day (1–2 cloves) or 300 mg dried garlic powder 2–3 times per day or 7.2 g per day (Bhandari, 2012)
<i>Ginkgo biloba</i> Family: Ginkgoaceae Common name: ginkgo, maidenhair tree, and ginkgo	Flavonol, flavone glycosides, and ginkgolides	Improve circulation and cognition (Boullata and Nace, 2000). An expectorant, antitussive, antiasthmatic, and memory impairment (Barnes et al., 2007)	Leaves and seeds	50 mg three times daily/6 months (Mullaicharam, 2013)
<i>Eleutherococcus senticosus</i> Family: Araliaceae Common name: Siberian ginseng, eleuthero, and Devil's shrub	Eleutherosides, ciwujianosides, and eleutherans	A general tonic, diabetes, hypertension, and depression (George, 2011)	Root	Adults: 10 ml/3 times per day for 21 days; 300–400 mg daily for 6–8 weeks (Brown, 2000)
<i>Piper methysticum</i> Family: Piperaceae Common name: Kava or kava kava	Kavalactones	Asthma, fever, syphilis, headaches, rheumatism and gonorrhea, and urinary infections (Barnes et al., 2007)	Rhizomes	Typical usage has ranged from 70 to 280 mg of kavalactones per day as one time of day dose or divided doses (60–120 mg of kavalactones per day). Several practitioners allegedly begin at a lower dose and measure up as needed (Ulbricht et al., 2005)
<i>Adiantum capillus-veneris</i> L. Family: Pteridaceae Common name: maidenhair fern, venus hair fern	Flavonoids, triterpenoids, aoleananes, phenylpropanoid, carbohydrates, carotenoids, and alicyclics	Asthma, chest colds, cough, edema, flu, and urinary disorder (Mahmoud and Gairola, 2013)	Herb	The drug is taken internally as a tea ready from the ground or fine-grained drug. The customary single dose is 1.5 g of the drug to one cup of liquid (Kirtikar and Basu, 2003)

residues of extraction solvent (Abdel-Azim et al., 2011). Several pharmacological studies have established the medicinal uses of Egyptian plants. Among others, validated and invalidated medicinal plants and their uses are described in Tables 1 and 2, respectively.

ECONOMIC VALUE OF MEDICINAL PLANTS IN EGYPT

In the last three decades, herb and herbal product markets have shown extensive growth all over the world. According to the Secretariat of the Convention on Biological Diversity, world sales of herbal products totaled approximately US\$60 billion in 2002 (WHO, 2003). Nowadays, herbal plants in Egypt have become attractive and confident medicinal sources as alternative remedies. Recently, medicinal plants, herbal drugs, herbal drug-based medicaments, and natural herb production are growing industries in Egypt (Fabricant and Farnsworth, 2001). Besides, Egypt has agricultural traditions with the largest biodiversity. In addition, exports of Egyptian medicinal and aromatic plants all over the world have become a major business and important source of income (Abdel-Azim et al., 2011).

Egypt is one of the African exporter's leaders in the field of medicinal and aromatic plant trade. Furthermore, Egypt was the fifth biggest exporter of medicinal plants in the world since its medicinal plant exportation reached 11,250 tons/year (US\$12.35 million) in the period from 1992 to 1995. In 1995, the annual export of perfumery, pharmaceutical, fungicidal and insecticidal plants was US\$13.79 million (Lange and Mladenova, 1997). But

in 2002, the Egyptian exports of medicinal plants returned to the seventh place (WHO, 2003). Although Egypt has not recently been in the ranks of the major exporters of medicinal plants, Egypt is located in the markets of medicinal and aromatic plants worldwide, with a trade volume of more than 60 billion dollars annually, which is a major exporter of 158.94 million dollars (Abdel El-Hamid et al., 2019).

The Egyptian flora has over 150 medicinal and aromatic plants that are globally famous for their high quality. The main crops exported are mint (*Mentha* spp.), basil (*Ocimum* spp.), sage (*Salvia* spp.), plants for herbal teas, and plants utilized for perfumery, insecticidal, and fungicidal purposes. Egypt was the main exporter of German chamomile (*Matricaria recutita* L.). About 500 to 600 tons of Egyptian henbane (*Hyoscyamus muticus* L.) are exported annually to Germany. Wild and cultivated Alexandrian senna (*Senna alexandrina* Mill.) is also a significant export item (Vasist and Kumar, 2004).

The aforementioned data revealed that the expanding interest in medicinal and aromatic plants, as new income-generating opportunities, is providing a complementary source of income for many extremely poor rural households. However, despite the fact that the medicinal and aromatic plants can have very high value in the final products, the farmer typically receives only a small share of the final value, either because they are unaware of the real value, unable to market it in the form wanted by consumers, or unable to market to these consumers.

Table 2. Invalidated medicinal plants and their prospective medicinal uses.

Name	Family	Local name	Used part	Traditional uses
<i>Aloe vera</i> L.	Aloaceae	Sabbar	Dried juice	Antidepressant, skin diseases, allergies, and headaches
<i>Atriplex</i> sp.	Amaranthaceae	Liqatf	Whole plant	Treatment of diabetes mellitus and antioxidant activity
<i>Anacyclus pyrethrum</i>	Asteraceae	Eaqir Qarhanaan	Roots	Emmenagogue, vermifuge, febrifuge, memory-enhancing, and antidepressant
<i>Artemisia Judaica</i>	Asteraceae	Shayh Khursan	Whole plant	Stomachic, expectorant, analgesic, diaphoretic, anthelmintic, antispasmodic in case of intestinal colic and keeping snakes away from houses, diabetic
<i>Aerva javanica</i> (Burm.f.) Juss.	Amaranthaceae	Shajirat Alaru-Altaraf	Roots and leaves	Against rheumatism, antidiarrheal
<i>Amaranthus graecizans</i>	Amaranthaceae	Alqatifu	Leaves	Anthelmintic, constipation, treat tonsillitis
<i>Brassica rapa</i> subsp. <i>rapa</i>	Brassicaceae	Alshaljma-Allaft Almahfur	Root	Antiscorbutic, aphrodisiac, hearing disorders
<i>Brassica nigra</i> L.	Brassicaceae	Alkhardal	Seeds	Alopecia, rheumatism and joint pains, toothache, and induration of the liver and spleen
<i>Balanites aegyptiaca</i> Del.	Balanitaceae	Alhijlij	Fruits	Antidiabetic, epilepsy, wounds, malaria, syphilis, Anthelmintic, dysentery, constipation, diarrhea, stomach, aches, asthma, fever, and hemorrhoid
<i>Calligonum polygonoides</i>	Polygonaceae	Artat mudlaea	Above ground part	Treatment of typhoid, eczema, cough and cold, asthma
<i>Cakile maritima</i>	Brassicaceae	Kakil	Whole plant	Digestive, appetizing, diuretic and antiscorbutic
<i>Chenopodium murale</i>	Chenopodiaceae	Zarbi	Above ground part	Intestinal tract pains and fever
<i>Citrullus colocynthis</i> (L.) Schrad.	Cucurbitaceae	Hanzil-Ealqim	Leaves, root, and fruit	Diabetes, asthma, carminative and antiepileptic, toothache, rheumatism, and leprosy
<i>Cleome droserifolia</i> (Forssk.) Delile	Capparaceae	Samuh	Leaves	Stomach ache, open wounds, diabetes, and skin allergies
<i>Cuscuta</i> sp.	Convolvulaceae	Alkashkut	Seeds	Frequent urination, impotence, and premature ejaculation
<i>Cassia fistula</i> L.	Fabaceae	Khia shambar	Fruits	Expectorant for brain and chest problems, detoxicant, tonic
<i>Euphorbia paralias</i> L.	Euphorbiaceae	Labna	Whole plant	Anti-inflammatory, antitumor
<i>Euphorbia granulate</i> Forssk.	Euphorbiaceae	Mlbanat-Haliba	Latex	As sources of minerals for man and animals. Internally for intestinal and externally for snake bites
<i>Embolia officinalis</i> Gaertn	Euphorbiaceae	Amlaj	Bark, dried fruit, and leaves	Laxative, stimulant, restoratives for all organs, anti-inflammatory, analgesic, and antipyretic ophthalmic disorders
<i>Ferula assa-foetida</i> Boiss. & Bush.	Apiaceae	Hilatayt	Rhizome and root	Strong nerve tonic, strong aphrodisiac, relieves ongoing mental, stimulant, and joint inflammation
<i>Lavandula coronopifolia</i> Poir.	Lamiaceae	Aldaram-Alafnadur	Leaves	Anti-inflammatory, hepatoprotective disorders, and stomach each
<i>Imperata cylindrica</i> (L.) Rausch	Poaceae	Halfanaan	Rhizome flowers	Antipyretic, diuretic, hemoptysis, pulmonary diseases
<i>Malva parviflora</i> L.	Malvaceae	Alkhabizuh	Leaves, root, and flower	Treatment of coughs and ulcers in the bladder, used to treat wounds and swellings, for astringent properties, pyorrhea
<i>Nerium oleander</i> L.	Apocynaceae	Tafaluh	Leaves	Helping to wound healing, relieves knee and back pain and cardiac illnesses and antidiabetic
<i>Nigella sativa</i>	Ranunculaceae	Habat Albarikata-Alhubat Alsuwda	Seeds	Digestive, analgesic, antihypertensive liver tonic, diuretic, improving memory
<i>Peganum harmala</i>	Zygophyllaceae	Harmal	Seeds	Analgesic, treat depression, mental and nervous illnesses, and hallucinogenic
<i>Rosmarinus officinalis</i> L.	Lamiaceae	Aklil aljabal-Hasaliban	Arial parts	Antidepressant, anxiety, analgesic in muscles and joints, poor memory and diuretic and antispasmodic in renal colic
<i>Rharri partite</i> (Ucria)	Anacardiaceae	Jadari	Fruits and leaves	Gastric, intestinal ailments
<i>Ruta graveolens</i> L.	Rutaceae	Alsadhab	Leaves	Dermatitis, pain and many inflammatory diseases, memory enhancer, relieves strokes and rheumatism
<i>Salvia triloba</i>	Lamiaceae	Adhaanah qasir-Marimih	Aerial parts	Nerve tonic, anti-inflammatory, diarrhea, enteritis, and memory enhancer
<i>Rumex vesicarius</i> L.	Polygonaceae	Hamid	Leaves	High content of oxalic acid, antitumor, constipation, bad digestion, and appetizer
<i>Salvadora persica</i> L.	Salvadoraceae	Sawaak	Roots, branches, leaves, and fruit	Analgesic, anticonvulsant, antimycotic, diuretic, carminative, anti-inflammatory, bleeding and clotting time activities
<i>Echinacea purpurea</i>	Asteraceae	Alakhnisia	Whole dried plant	Antitoxin for snake bites, anti-inflammatory toothache, bowel pain treating skin disorders, seizure, and cancer

(Continued)

Name	Family	Local name	Used part	Traditional uses
<i>Salvia aegyptiaca</i> L.	Lamiaceae	Alsiliaa Almisrih	Above ground part	Cicatrizant, Nervous disorders, dizziness, trembling, stomachic, diarrhea, and strong antimicrobial and antioxidant effects
<i>Senna alexandrina</i> Mill.	Fabaceae	Sinamiki	Leaves	Anti-inflammatory, Parasite Cleaning stimulant laxative, bowel evacuation
<i>Senna italic</i> Mill.	Fabaceae	Alsanamikiu al'iitali	Leaves	Stimulant laxative, bowel evacuation and antibacterial and antitumor properties
<i>Tamarix nilotica</i> (Ehrenb.) Bunge	Tamaricaceae	Tarafaan-Labe	Leaves	Antiseptic, an antiseptic agent, Hemorrhoids, resting relieve headache, draw out inflammation
<i>Terminalia arjuna</i> (Roxb.) Wight & Arn.	Combretaceae	Haliy 'aswad	Fruits	Heart diseases, skin diseases, improves memory and brain function
<i>Tribulus terrestris</i> L.	Zygophyllaceae	Aljaris	Fruits	Diuretic, useful for asthma, cough, or cold. Natural nutritional supplement, help impotence and heart disease
<i>Zilla spinosa</i> (L.) Prantl	Brassicaceae	Alat-Shabaram	Whole dried plant	Treat liver and kidney diseases, paralysis, diabetes, and urinary tract diseases
<i>Ziziphus spina-christi</i> L. Desf.	Rhamnaceae	Sdr-Nabaq	Leaves	Colds, hypertension, astringent anthelmintic, antidiarrheal, and demulcent
<i>Zygophyllum coccineum</i> L.	Zygophyllaceae	Batibat	Fruits and seeds	Anthelmintic, rheumatism, antipyretic, antihistamine, lowering in blood pressure, and diuretic
<i>Zygophyllum simplex</i> L.	Zygophyllaceae	KaramilS	Leaves and seeds	Anthelmintic, horny patches on the skin, and applied to eyes in cases of ophthalmia and leucoma
<i>Zingiber officinale</i> Roscoe	Zingiberaceae	Zanjibayls	Rhizome	Osteoarthritis, joint inflammation, pain reliever, and rheumatoid arthritis

CHALLENGES OF EGYPTIAN MEDICINAL PLANTS

The development and regulation of traditional medicines all over the world are often confronted with several challenges (Ekor, 2014). Regulatory status, efficacy assessment, quality control, safety monitoring, and inadequate or poor knowledge about traditional medicines within national authorities are common in many countries (WHO, 2005). Moreover, sharing the regulatory herbal medicines information between drug regulatory authorities and safety monitoring centers is an additional major challenge (WHO, 2004). From the economic point of view, in the developing countries, including Egypt, there are many challenges that prevent their entry into the global trade market and put them in a bad position (Samal *et al.*, 2004). Regarding that, the traditional Egyptian medicines lack the following:

- Scientific evidence though well-documented efficacy and safety use with a proven scientific basis.
- Uniform quality standards of the collected material from different places of origin.
- The necessary information about the requirements of the international market and the technologies required to upgrade their produce.
- Intellectual Property Rights: extensive documentation to protect the traditional medicines from exploitation and biopiracy.
- Sustainable cultivation as well as postharvest and processing technologies.
- Value addition through processing into a more consumer useable form.
- Marketing strategies that make the grassroots level people have an equitable share in the profits.

RECOMMENDATIONS FOR EGYPTIAN HERBAL MEDICINE DEVELOPMENT

The future of Egyptian medicinal plants needs to develop the handling stages (e.g., cultivation, collection, processing, storage, marketing, and research), which should be encouraged by a proper guidelines framework to face the present challenges such

as regulatory concerns, consumer perceptions, and competitions. Currently, the Egyptian producers of herbal plants need to consider the following areas to enter the global market:

- Cultivation of medicinal plants must be achieved in Good Agricultural Practice (GAP) and organic farming methods to ensure their safety. GAP includes comprehensive items such as ecological properties, locations, germplasm, cultivation, validation, identification of active compounds and metal elements, and pesticide detection.
- Advancing towards the isolation of pure bioactive compounds or substances, instead of the plant parts, with appropriate investigations of their activity and toxicity should be considered.
- Scientific researches and reliable data are required for the trusted use of herbal drugs in healthcare systems.
- The environmental ethics code should be considered to maintain the biodiversity of natural resources and prevent the loss of medicinal plant species due to high harvesting and destruction of habitats.
- The empirical guidelines should be replaced with evidence-based ones to increase the confidence use of herbal medicine through training the researchers and practitioners in the use of plant compounds.
- Finally, the aspects of efficiency, safety, acute and chronic toxicities, accurate dose, duration of treatment, side effects, and standardization of herbal drugs should be considered in order to achieve safe, effective, and affordable herbal drugs.

CONCLUSION

The demand for natural products has increased all over the world. In developing countries, about 85% of the people are treated with folk medicaments, especially herbal drugs. These demands are predominantly driven by the adverse effects of synthetic drugs. Therefore, the importance of medicinal plants has become significantly more than ever. More researchers are needed in the areas of the herbal plant through discovering new plants and drugs as well as phytochemical, biological, and clinical studies. Despite the long

history of plant medicine use in folk healing systems, identification of active herbal ingredients can lead to discovering new prospective therapeutic uses and production of natural drugs. To perform these targets, great efforts should be made in the quality control of raw and formulated drugs to validate their use in the modern healthcare system. In this concern, biological and clinical studies are demanded to maximize the profits of these plants. In addition, a practical plan should be established to preserve the medicinal plants' resources. Medicinal plants are not only the sources of adjuvant diseases therapy but also for diseases prevention and maintaining health.

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All authors made substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; took part in drafting the article or revising it critically for important intellectual content; agreed to submit to the current journal; gave final approval of the version to be published; and agree to be accountable for all aspects of the work. All the authors are eligible to be an author as per the international committee of medical journal editors (ICMJE) requirements/guidelines.

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