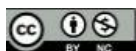


Adulterations in Medicinal Plants and Herbal Medicines: Role of Universities in Quality Assessment

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Abstract

The use of medicinal plants is increasing worldwide; however, the absence of effective quality assurance has resulted in the presence and distribution of adulterations. Adulteration appears intentionally or unintentionally, both of which lead to serious consequences for public health. The present policy note evaluates the extent of the subject and emphasizes the central role of universities in preventing and controlling adulteration in medicinal plants and herbal medicines. By conducting research, developing infrastructures for laboratories, training expert technicians, and also improving the knowledge of the public, universities can play a significant role in preventing this problem. Improving these capabilities will result in a systematic quality assurance for safe use of medicinal plants and herbal medicines.

Keywords: Medicinal plants; Adulterations; Quality control; University

1. Context

Recently, people have a more pronounced tendency to use medicinal plants. They prefer to use natural therapies that have fewer side effects and lower costs. Also, the growing market of natural remedies has reinforced this trend (1,2). Referring to traditional therapies has an ancient history in Iran, a country with significant records in traditional medicine. People in general, use natural and mostly herbal therapies in Iran. Regarding the growing tendency, lack of a systematic quality assurance will lead to adulterations which needs urgent management.

Any type of intentional or unintentional manipulation in the content, identity or quality of the medicinal plants for financial gains is defined as adulteration (3). It is both an economic contravention and a threat to public health. If people use adulterations instead of the real therapies, they might suffer from side effects (sometimes severe ones) and the treatment will also fail. Poisoning, interactions with other drugs and sometimes death are other factors to be considered (2).

2. Methods

Reliable sources including high quality related articles and globally validated organization sources like World Health Organization published guidelines, were used to prepare this brief policy.

3. Results

Types of adulterations

There are three main phases that adulterations in medicinal plants occur (1,3,4).

1. Raw material

-The resemblance in appearance leads the medicinal plants to be substituted by another plant which are reachable, less expensive and even non-medicinal.

-Unsuitable parts of the plant which are not the main parts for medicinal use would be presented which results in the reduction of active constituents of the plant (for example adding stems or broken pieces of the roots to the leaves).

2. Processed and finished product

-Non-standard, low quality or improper material might be added to the extracts, essential oils, or distillates of the medicinal plants.

- Instead of the real plant content, synthetic flavours or colours that resemble the taste and colour might be added.

-Chemical pharmaceuticals might be added for intensifying the effects.

3. Distribution and marketing

-Products without licence from official sources might be distributed.

-Wrong and misleading labelling such as “**all natural**”, “**no side effects**”, might be used.

-Handmade or bulk products might be distributed with false and large claims of medicinal effects without enough scientific support.

-There might be false claims about the presence of special active materials in some products, as for ginseng in many tonics.

Consequences of adulterations

Presenting adulterations instead of true medicinal plants has wide-range of consequences.

Decline in therapeutic results, adverse effects and sometimes poisoning, plant-drug and plant-food interactions, and interfering with laboratory tests are just a few consequences of using adulterations. Other costs might include the expenses of increased need for monitoring the patients and extra costs for treatment. Besides, the reputation of legitimate producers might be damaged ([1,2](#)).

Existing challenges

There are some challenges ahead. Sometimes, the supply chain is not supervised enough and expert quality control laboratories are not enough. Lack of comprehensive authentication and identification standards is another challenge. There are also a huge number of products available online which makes official supervision harder for all of them. Another important challenge is the unawareness and lack of proper knowledge of the consumers of the natural and herbal products ([5](#)).

Policy recommendations

Here are recommendations for an attempt to reduce adulterations of herbal materials ([6](#)).

1. Establishing a system for monitoring and tracking herbals from production to distribution
2. Expanding and equipping quality control laboratories for herbal authentication
3. Setting up national standards for quality control and labelling
4. Improving legal enforcement against producers and distributors who present adulterations instead of true products

5. Increasing the public education and knowledge about the importance and identifying true products
6. Supporting licensed and certified producers

The role of universities in preventing and controlling adulterations

The production of medical plants and herbal medicines is complicated and comprises different stages. Preventing and controlling adulterations needs scientific knowledge, use of modern technologies and expert staff, the nature of which highly depend on universities. Thus, the role of universities can be explained as follows:

1. Scientific support and authentication technologies

Universities perform basic and applied research and can conduct experiments for detection of adulterations. Universities develop standard and accurate methods for quality assessment and authentication of herbal materials using modern technologies including spectroscopic techniques, chromatographic methods (HPLC, GC-MS), metabolomics and chemical marker analysis, molecular and genetic methods (DNA barcoding), and also use of AI for recognizing the adulteration patterns.

2. Training expert technicians

Universities are educational bodies and can train skilled staff for supervising and controlling herbal products. Experts trained in plant identification, quality control, and relevant regulations are essential for prevention of adulterations. There might be a need for revising the curriculum of some majors to comprise subjects such as herbal adulteration, quality control methods, international standards and management in herbal supply chain. Teaching the use of pharmacopoeias of different countries can improve graduates' scientific competence.

3. Establishing specialised quality control laboratories for herbal medicines

Universities can act as scientific arms of regulatory agencies by setting up specialized laboratories. These centres can evaluate market samples, verify product authenticity, detect microbial and chemical contaminants, and provide reliable scientific reports to regulatory organisations. Such laboratories increase the speed of detecting counterfeit products and reduce the entry of non-standard products into the market.

4. Scientific collaboration with regulatory organizations and industry

Universities play a key role in linking science, industry, and policy-making. Collaboration with the Ministry of Health, Food and Drug Organization, National Standards Organization, and herbal product manufacturers can help develop national standards, design quality control guidelines, and create product

tracking systems. Universities can also advise manufacturers to improve quality and reduce the risk of adulteration.

5. Public education

Universities have a key role in increasing health knowledge in terms of safe use of herbal medicines. By holding workshops, conferences, and attending in media, providing training for herbal sellers, and establishing public education programmes, universities can educate consumers about the risks of adulterations, and the importance of buying from authorised sources. Increased public awareness results in a raise demand for standard products and confines the market for counterfeit material.

6. Policy-making and standard setting

Academics as universities researchers and teachers are scientific advisors in the development of national policies related to herbal medicines. Their participation in expert committees and standard-setting working groups ensures that policies are scientific. Universities can conduct studies to determine the true dimensions of herbal adulterations and its impact on public health, providing crucial data for policy makers.

In this section, policy options and implementable solutions to resolve the problem are introduced and evaluated using the findings of selected research evidence.

4. Discussion

Universities, are the most important and crucial centres of knowledge for generating awareness and technology, while playing a critical role in preventing and controlling adulterations in herbal medicines. Developing scientific research, training specialised human resources, establishing reference laboratories, raising public awareness, and participating in policy-making are among the most important academic capacities in this field. Strengthening the collaboration among universities, industry, and regulatory organizations can lead to an efficient system for ensuring the quality and safety of herbal products, thereby effectively protecting public health.

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Conflict of interest

The author declare that there is no conflict of interest.

AI Using Declaration

Chat GPT was used for language and grammar corrections. The final output was read and modified by author.

Author's contributions

The author equally contributed to preparing this article.

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