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Medicinal Plants Effective in Addiction Treatment in Iranian Traditional Medicine and Their Mechanisms of Action: A Review

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Abstract

Background and Aim: Substance use disorder (SUD), particularly narcotic addiction, is a major global public health challenge associated with profound physical, psychological, and social consequences. This review aims to identify medicinal plants effective in addiction treatment from the perspective of Iranian Traditional Medicine (ITM) and to examine their potential pharmacological mechanisms of action.

Methods: A comprehensive literature review was conducted, integrating authoritative ITM sources (classical books and manuscripts by renowned sages) with recent scientific literature. Relevant articles were retrieved from both international and national databases using relevant keywords. Inclusion criteria comprised studies reporting the effects of medicinal plants on reducing substance dependence and withdrawal symptoms, supported by credible ITM references. Studies lacking empirical data or direct relevance were excluded.

Results: ITM traditionally utilizes several plants, including *Melissa officinalis* L., *Valeriana officinalis* L., *Borago officinalis* L., *Crocus sativus* L., *Cichorium intybus* L., *Berberis vulgaris* L., *Glycyrrhiza glabra* L., *Matricaria chamomilla* L., *Mentha spicata* L., *Lavandula angustifolia* Mill., and *Zingiber officinale* Roscoe. These plants are traditionally employed to modulate temperamental imbalances, strengthen the nervous system, reduce anxiety and depression, and support hepatic and blood detoxification, thereby alleviating withdrawal symptoms.

Conclusion: The use of medicinal plants in ITM may provide a safe and effective complementary approach for addiction cessation and mitigation of dependency symptoms. Nonetheless, further well-designed, controlled human clinical studies are required to determine appropriate dosages, evaluate potential adverse effects, and substantiate their therapeutic efficacy. Integrating traditional ITM knowledge with modern pharmacological methodologies could unlock novel, evidence-based strategies for addiction treatment and relapse prevention.

Keywords: Addiction, Iranian Traditional Medicine, Medicinal Plants, Complementary Therapy, Temperamental Balance

Introduction

Mental disorders constitute one of the most significant global public health challenges, profoundly impacting individuals' quality of life, social functioning, and overall societal well-being (1–3). Among these, substance use disorder (SUD), particularly involving narcotics and psychoactive substances, represents a critical concern, leading to extensive physical, psychological, social, and economic consequences (1). Globally, over 35 million people suffer from SUDs, and millions succumb annually to related complications (2).

Conventional treatment strategies for addiction typically integrate pharmacotherapy, psychotherapy, and social interventions. However, the limited long-term efficacy and the potential for adverse effects associated with synthetic drugs underscore the critical need to explore safer and complementary therapeutic options (3). In modern medicine, pharmacological approaches to addiction primarily target the central nervous system. These strategies include opioid substitution therapies (e.g., methadone and buprenorphine to alleviate withdrawal symptoms), receptor antagonists (e.g., naltrexone to reduce craving), enzyme inhibitors, and adjunctive use of antidepressants or anxiolytics to manage coexisting anxiety and depression (4, 5). Despite their utility, these pharmacotherapies are not without limitations. Common adverse effects include physical or psychological dependence, gastrointestinal issues (nausea), headaches, sleep disturbances, hepatic or renal dysfunction, and a persistent risk of relapse (6, 7).

From a pathophysiological standpoint, addiction is characterized as a chronic disorder of the central nervous system. It involves significant structural and functional alterations in the brain’s reward centers, dysregulation of key neurotransmitter systems (dopaminergic, serotonergic, and noradrenergic pathways), and impaired emotional and motivational regulation (8). These profound changes contribute to both physical and psychological dependence, making the withdrawal process particularly challenging and contributing to high relapse rates (9).

In contrast, Iranian Traditional Medicine (ITM) views addiction as a consequence of disrupted temperamental balance (Mizaj) and impaired natural faculties. Substance abuse is traditionally believed to disturb the equilibrium of basic qualities (hot/cold, wet/dry) and disrupt the flow of vital energies, ultimately compromising cerebral, hepatic, and nervous functions (10–12). Accordingly, ITM interventions for addiction are fundamentally aimed at temperamental correction, detoxification, strengthening vital faculties, and supporting the functions of the liver and nervous system (13). These holistic approaches often combine dietary regulation, lifestyle modifications, and the use of medicinal plants to mitigate withdrawal symptoms, reduce anxiety and depression, and restore physical and mental balance (12, 13).

Medicinal plants are known to exert therapeutic effects through diverse mechanisms, such as modulation of neurotransmitter systems, attenuation of neuroinflammation, enhancement of antioxidant capacity, and support of hepatic and immune function (14). The growing interest in herbal therapy for addiction stems from its potential to offer therapeutic benefits while reducing the side effects associated with synthetic drugs, thereby empowering individuals to restore psychological and physical health and minimize the risk of relapse (13).

Given the multifactorial complexity of addiction treatment, the inherent limitations of conventional pharmacotherapy, and the continuous necessity for relapse prevention, the exploration of medicinal plants effective in addiction, specifically through the lens of ITM and analysis of their scientific mechanisms, offers a promising avenue for developing natural, safe, and complementary strategies to improve therapeutic outcomes. This review aims to consolidate the traditional knowledge concerning addiction treatment in Iranian Traditional Medicine and systematically analyze the evidence supporting the efficacy and mechanisms of relevant medicinal plants.

Methods

The objective of this review was to identify medicinal plants effective in addiction treatment according to Iranian Traditional Medicine (ITM) principles and to examine their underlying biological mechanisms. The review followed a structured and systematic approach to ensure scientific rigor.

Search Strategy

A comprehensive literature search was conducted in two phases. First, classical ITM texts and manuscripts addressing addiction and related disorders were thoroughly examined. Second, electronic searches were performed in national and international databases, including PubMed, Scopus, Google Scholar, SID, and Magiran, to identify the most recent and relevant scientific articles.

Keywords used in the search included “addiction,” “substance dependence,” “medicinal plants,” “herbal therapy,” “Iranian Traditional Medicine,” and “mechanisms of action,” along with their Persian equivalents. Boolean operators (AND, OR) were employed to combine terms, ensuring both breadth and precision in the search. The search included all publications up to [insert date].

Inclusion Criteria

- Studies evaluating the effects of medicinal plants on addiction prevention, treatment, reduction of dependency, or alleviation of withdrawal symptoms.
- ITM references explicitly describing plants traditionally used for addiction-related disorders.

- Experimental, clinical, and preclinical studies providing empirical data.
- Publications available in full text in English or Persian.

Exclusion Criteria

- Articles without full-text access or insufficient methodological detail.
- Review articles, editorials, and commentaries lacking primary empirical data.
- Studies focusing on psychiatric disorders or conditions unrelated to addiction.
- Research on non-herbal interventions, such as pharmaceuticals or behavioral therapies.
- Sources lacking scientific validity or reliability.

Data Extraction and Analysis

Relevant data were systematically extracted and categorized according to therapeutic effects and proposed mechanisms of action. The information was then organized into thematic groups and presented in tables and figures to facilitate clear analysis and comparison across studies.

Results

Analysis of the review revealed that plants such as *Melissa officinalis* L., *Valeriana officinalis* L., *Borago officinalis* L., *Crocus sativus* L., *Cichorium intybus* L., *Berberis vulgaris* L., *Glycyrrhiza glabra* L., *Matricaria chamomilla* L., *Mentha spicata* L., *Lavandula angustifolia* Mill., and *Zingiber officinale* Roscoe are among the most prominent herbal remedies used in ITM for addiction management. These plants are traditionally employed to regulate temperamental imbalances, strengthen the nervous system, alleviate anxiety and depression, and detoxify the liver and blood, thereby mitigating withdrawal symptoms. Detailed botanical information, traditional uses, and therapeutic effects of these plants are summarized in Table 1.

Table 1: Medicinal Plants Effective in Addiction Cessation

English Name	Scientific Name	Family	Plant Part Used	Traditional Use	Plant Type	Mechanism of Action
Lemon Balm	*Melissa officinalis* L.	Lamiaceae	Leaves	Sedative, nerve tonic, reduces anxiety and depression	Perennial	Enhances GABAergic activity; anxiolytic; anti-inflammatory
Valerian	*Valeriana officinalis* L.	Valerianaceae	Root	Sedative, alleviates anxiety and insomnia	Perennial	Increases GABA neurotransmission in the brain
Borage	*Borago officinalis* L.	Boraginaceae	Leaves and flowers	Strengthens nerves, reduces anxiety, improves mood	Annual	Enhances dopamine; sedative; anti-inflammatory
Saffron	*Crocus sativus* L.	Iridaceae	Stigma	Antidepressant, cognitive enhancer, blood purifier	Perennial	Increases serotonin; antioxidant; anti-inflammatory
Chicory	*Cichorium intybus* L.	Asteraceae	Root and leaves	Liver detoxification, liver tonic, improves digestion	Perennial	Hepatoprotective; anti-inflammatory
Barberry	*Berberis vulgaris* L.	Berberidaceae	Fruit and root	Blood purifier, liver tonic, anti-inflammatory, antimicrobial	Perennial	Antibacterial; antioxidant
Licorice	*Glycyrrhiza glabra* L.	Fabaceae	Root	Anti-inflammatory, nerve tonic, gastrointestinal soothing	Perennial	Anti-inflammatory; cortisol inhibition; anxiolytic

Chamomile	*Matricaria chamomilla* L.	Asteraceae	Flowers	Sedative, anti-inflammatory, nerve calming	Annual	Anti-inflammatory; supports central nervous system function
Mint	*Mentha spicata* L.	Lamiaceae	Leaves	Sedative, antispasmodic, nerve tonic	Perennial	Antispasmodic; neural calming effects
Lavender	*Lavandula angustifolia* Mill.	Lamiaceae	Flowers	Sedative, reduces anxiety, soothes nerves	Perennial	Enhances inhibitory neurotransmission
Ginger	*Zingiber officinale* Roscoe	Zingiberaceae	Rhizome	Improves circulation, anti-inflammatory, nerve tonic	Perennial	Anti-inflammatory; antioxidant

Discussion

Addiction to narcotics is a chronic and complex disorder with wide-ranging physical, psychological, and social consequences. Continuous use of substances such as heroin, morphine, cocaine, or alcohol leads to both physical and psychological dependence. Effective management of this disorder requires a comprehensive approach encompassing pharmacological, psychological, and social interventions. In ITM and other traditional healthcare systems, medicinal plants have been employed to reduce craving and manage withdrawal symptoms (22).

Evidence suggests that certain traditional plants, including *Radix Puerariae*, peyote, ginseng, kava, *Thunbergia laurifolia*, *Withania somnifera*, and *Salvia miltiorrhiza*, may serve as adjuncts to conventional pharmacotherapy for addiction cessation and relapse prevention, often offering lower cost and fewer side effects (22). However, clinical evidence remains limited, and further research is necessary to confirm their efficacy (23).

Several studies indicate that plants such as *Hypericum perforatum*, *Valeriana officinalis*, *Passiflora incarnata*, *Rosmarinus officinalis*, *Papaver rhoeas*, *Tabernanthe iboga*, *Ginkgo biloba*, *Salvia miltiorrhiza*, *Pueraria lobata*, *Opuntia ficus-indica*, *Cynara scolymus*, *Panax ginseng*, melatonin, ibogaine, and their derivatives can potentially reduce opioid and alcohol consumption, although evidence is insufficient to recommend them as primary treatments (23). Furthermore, Chinese medicinal plants such as ginseng, Yanhusuo, Gouteng, Danshen, and Gengen have shown efficacy in reducing substance use and preventing relapse, with active compounds such as sinomenine and L-stefolidin demonstrating therapeutic potential for opioid dependence (24).

Animal studies have demonstrated that extracts from *Passiflora incarnata*, *Pueraria lobata* (kudzu), *Salvia miltiorrhiza*, and *Salvia przewalskii* can reduce alcohol and nicotine consumption and alleviate withdrawal symptoms (25). Conversely, certain traditionally used psychoactive plants, including khat, kratom, *Salvia*, and mandrake, may induce dependence and cognitive deficits when consumed chronically (26).

Other plants, such as *Trachyspermum copticum*, *Melissa officinalis*, *Avena sativa*, *Hypericum perforatum*, *Passiflora incarnata*, *Valeriana officinalis*, *Satureja hortensis*, and *Mentha piperita*, have shown efficacy in alleviating morphine withdrawal symptoms and improving the behavioral and psychological status of addicted individuals (27). Specifically, *Melissa officinalis* exhibits anxiolytic effects and reduces compulsive-like behaviors through interactions with opioid receptors (28). *Valeriana wallichii* increases GABA levels in the cortex and hippocampus, reducing alcohol withdrawal-induced anxiety and voluntary alcohol intake in mice, with effects dependent on GABA_A receptor activity, highlighting its promising anti-addictive potential (29).

Additionally, *Crocus sativus* (saffron), through active constituents such as safranal, crocin, and crocetin, mitigates morphine tolerance and withdrawal symptoms (30). Extracts of *Borago vulgaris* root combined with methadone can improve opioid withdrawal syndrome, although significant effects on anxiety, depression, stress, or sleep quality are limited (31). Acute and

chronic administration of *Matricaria chamomilla* (chamomile) also reduces morphine withdrawal symptoms (32). Furthermore, ginger extract (100 mg/kg) has been shown to decrease morphine-induced addictive-seeking behavior (32).

The active phytochemical constituents of these plants demonstrate the capacity to modulate central nervous system (CNS) pathways, thereby alleviating key withdrawal symptoms such as anxiety, insomnia, and irritability. Preclinical evidence, derived from both in vitro and in vivo (animal) studies, suggests that these herbal extracts can significantly reduce addictive behaviors, indicating their potential as safe and accessible adjuncts to conventional treatment modalities. Furthermore, many of these plants exert their effects by interacting with critical neurotransmitter systems, including the opioid and GABAergic pathways, contributing to the mitigation of stress and anxiety associated with the withdrawal phase.

Traditional knowledge regarding medicinal plants is of considerable importance, as the empirical evidence accumulated by previous generations can inform the identification of potentially efficacious plant species and guide modern drug discovery. Furthermore, the presence of diverse bioactive secondary metabolites in these plants provides a robust scientific foundation for the development of novel therapeutic agents targeting a wide range of diseases (33-38).

Limitations and Clinical Recommendations

Nevertheless, most current evidence supporting the use of these botanical agents is predominantly derived from preclinical (animal and *in vitro*) studies, with human clinical trials generally limited in scope and sample size. Consequently, while promising, these plants cannot be recommended as stand-alone primary treatments for complex conditions such as substance use disorder. Instead, they should be considered complementary and adjunctive therapies, used in conjunction with established pharmacological and psychological interventions.

It is crucial to acknowledge that certain traditionally or recreationally consumed plant species may harbor the potential for addiction or cognitive impairment, necessitating a focus on safe and scientifically guided usage. Furthermore, the active phytochemical constituents of many plants require rigorous investigation to precisely determine effective dosages, long-term safety profiles, and potential pharmacokinetic or pharmacodynamic interactions with existing conventional medications.

Conclusion

Overall, medicinal plants demonstrate substantial therapeutic potential as complementary and adjunctive therapies for addiction cessation and the effective management of dependence-related symptoms. Their demonstrated capacity to mitigate addictive behaviors and alleviate withdrawal-associated anxiety suggests they can provide effective psychological and physiological support with minimal reported adverse effects. However, to translate these preclinical and traditional findings into practical, standardized, and evidence-based therapeutic strategies, rigorous and extensive, controlled human clinical trials are essential.

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Conflict of Interest

The authors declare that they have no conflict of interest.

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