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Ethnobotanical Insights into Medicinal Plants and Their Mechanisms for Blood Pressure Control

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A B S T R A C T

Objective: Hypertension, characterized by elevated arterial blood pressure, constitutes a significant risk factor for a range of severe health complications, including cardiovascular disease, renal impairment, atherosclerosis, ocular damage, and stroke. This study aims to identify medicinal plants traditionally employed in the western region of Iran for the management of hypertension.

Method: A comprehensive literature search was conducted to identify ethnobotanical knowledge pertaining to the use of medicinal plants for hypertension management in western Iran. The search encompassed the following databases: Google Scholar, SID, Magiran, PubMed, and Scopus. Relevant articles were retrieved using the keywords "medicinal plants," "Iran," "blood pressure," "Urmia," "Tabriz," "Kurdistan," "Kermanshah," "Ilam," "Khuzestan," and "ethnobotany."

Results: Medicinal plants including *Foeniculum vulgare* Mill., *Achillea millefolium* L., *Fumaria officinalis* L., *Apium graveolens*, *Urtica dioica* L., *Crataegus pontica* C. Koch., *Rheum ribes* L., *Allium schoenoprasum*, *Achillea biebersteinii*, *Achillea millefolium*, *Prunus cerasifera*, *Gentian olivieri*, *Olea europaea* L., *Rumex pulcher* L. and *Crataegus monogyna* L. are antihypertensive medicinal plants in western Iran.

Conclusion: Emerging evidence suggests that certain medicinal herbs and spices possess antihypertensive properties, demonstrating their potential as adjunctive or alternative therapeutic agents for blood pressure management.

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Introduction

Cardiovascular diseases represent a leading cause of mortality globally, including in Iran and the United States [1]. Hypertension, a primary cardiovascular condition, is characterized by elevated blood pressure. This pathological state arises from the loss of arterial elasticity and the narrowing of smaller blood vessels [2]. Hypertension is often referred to as the "silent killer" due to its insidious onset and lack of early symptoms [3]. While transient blood pressure elevations may occur in response to stress or physical exertion, sustained hypertension is defined by persistently elevated blood pressure levels at rest [4].

Hypertension, a prevalent cardiovascular disorder, is characterized by elevated blood pressure resulting from the forceful exertion of blood against arterial walls. Its insidious nature, often lacking early symptoms, has earned it the moniker "silent killer." While transient blood pressure fluctuations occur in response to physiological stressors, sustained hypertension is a pathological condition with far-reaching consequences [5]. A multitude of factors contribute to the development of hypertension. Age, obesity, smoking, excessive alcohol consumption, and an unhealthy diet rich in sodium and saturated fats, coupled with a sedentary lifestyle, are established risk factors [5]. Additionally, genetic predisposition, hormonal influences, and certain medical conditions, including thyroid disorders, can

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predispose individuals to hypertension [5]. The deleterious effects of uncontrolled hypertension are substantial, encompassing stroke, myocardial infarction, congestive heart failure, kidney dysfunction, and ocular complications [6]. Management of hypertension necessitates a multifaceted approach encompassing both preventive and therapeutic strategies. Lifestyle modifications, including weight reduction, smoking cessation, regular blood pressure monitoring, physical activity, stress management, and dietary adjustments, are fundamental to hypertension control [7]. When lifestyle interventions prove insufficient, pharmacotherapy is indicated. Antihypertensive agents, such as beta-blockers (e.g., atenolol), alpha-blockers (e.g., prazosin), calcium channel blockers (e.g., nifedipine), diuretics (e.g., thiazides, furosemide, spironolactone), angiotensin-converting enzyme inhibitors (e.g., enalapril), and angiotensin receptor blockers (e.g., losartan), are commonly prescribed. However, it is essential to acknowledge the potential adverse effects associated with these medications [8-10].

The utilization of medicinal plants in disease management dates back to antiquity [11]. In particular, their application in hypertension management has garnered significant attention [12]. These botanicals have been traditionally employed due to their perceived cardiovascular benefits. Emerging evidence supports the hypotensive properties of certain plants and spices, positioning them as potential adjuncts to conventional antihypertensive therapies [13, 14].

Ethnobotany represents the interdisciplinary study of the relationship between people and plants, encompassing traditional knowledge and practices surrounding plant use. By systematically documenting the medicinal applications of plants across various cultures, ethnobotany serves as a valuable resource for drug discovery [15]. Given the rich ethnobotanical heritage of Iran's western provinces, this study aimed to elucidate the traditional knowledge of medicinal plants employed in the management of hypertension.

Method

A literature search was conducted using the keywords "medicinal plants," "Iran," "hypertension," "Urmia," "Tabriz," "Kurdistan," "Kermanshah," "Ilam," "Khuzestan," and "ethnobotany." The search encompassed multiple databases, including Google Scholar, SID, Magiran, PubMed, and Scopus. Relevant ethnobotanical studies were included in the review.

Results

Based on the results obtained from reviewing the ethnobotanical articles of the western provinces of Iran, it was determined that medicinal plants including Foeniculum vulgare Mill., Achillea millefolium L., Fumaria officinalis L., Apium graveolens, Urtica dioica L., Crataegus pontica C. Koch., Rheum ribes L., Allium schoenoprasum, Achillea bieberlleerarunus, Gentian olivieri, Olea europaea L., Rumex pulcher L., and Crataegus monogyna L. are antihypertensive medicinal plants in western Iran (Table 1).

Table1. Antihypertensive medicinal plants used in the western provinces of Iran based on the ethnobotanical knowledge of each region

Area	Organ	Plant family	The name of the plant	Scientific name	Possible Antihypertensive Mechanism
Meshkin Shahr, Ardabil	Seed, root	Apiaceae	Fennel	Foeniculum vulgare Mill.	Acts as a diuretic, reduces vascular resistance
Meshkin Shahr, Ardabil	Aerial organs	Asteraceae	Yarrow	Achillea millefolium L.	dilate blood vessels and relax smooth muscle
Meshkin Shahr, Ardabil	Aerial organs	Papaveraceae	Fumitorie	Fumaria officinalis L.	Modulate vascular tone and reduce blood pressure
Urmia, West Azerbaijan	Aerial organs	Apiaceae	Celery	Apium graveolens	Relax smooth muscles of the arteries and reduce blood pressure

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Behbahan, Khuzestan	Aerial organs	Urticaceae	Nettles	Urtica dioica L.	Acts as a diuretic and has anti-inflammatory effects that may reduce hypertension
Dehlran and Abdanan, Ilam	Fruit	Rosaceae	Hawthorn	Crataegus pontica C. Koch.	Improve coronary blood flow and reduce peripheral resistance
Dehlran and Abdanan, Ilam	Stem	Polygonaceae	Rhubarb	Rheum ribes L.	Contribute to lowering blood pressure
Sarein, Ardabil	Leaves and onions	Alliaceae	Fresh Chives	Allium schoenoprasum	Lower blood pressure by reducing cholesterol levels and acting as a vasodilator
Sarein, Ardabil	Leaves and flowers	Asteraceae	Yarrow	Achillea biebersteinii	Potentially lowers blood pressure through vasodilation and anti-inflammatory effects
Sarein, Ardabil	Leaves and flowers	Asteraceae	Yarrow	Achillea millefolium	Mild diuretic properties, potentially reducing blood pressure
Sarein, Ardabil	Fruit	Rosaceae	Prunus cerasifera	Prunus cerasifera	Improve endothelial function, act as antioxidants, and promote vasodilation
Saqqez, Kurdistan	Flowers	Gentiniaceae	Gentian	Gentian olivieri	Mild diuretic properties, potentially reducing blood pressure
East of Khuzestan, Khuzestan	Fruit	Oleaceae	Olive	Olea europaea L.	Lower blood pressure by improving endothelial function
East of Khuzestan, Khuzestan	Root	Polygonaceae	Sorrel	Rumex pulcher L.	Anti-inflammatory properties that contribute to blood pressure reduction
Ajab Shir, East Azerbaijan	Fruit	Rosaceae	Hawthorn	Crataegus monogyna L.	Improve coronary artery blood flow and reduce vascular resistance

Descriptive statistics for the distribution of plant families are as follows:

Asteraceae family: Three samples (Achillea millefolium L., Achillea biebersteinii, Yarrow)

Apiaceae family: Two samples (Foeniculum vulgare Mill., Apium graveolens)

Rosaceae family: Two samples (Crataegus pontica C. Koch., Crataegus monogyna L.)

Polygonaceae family: Two samples (Rheum ribes L., Rumex pulcher L.)

Other families: Only one occurrence each for Papaveraceae, Urticaceae, Alliaceae, Gentiniaceae, and Oleaceae.

Distribution of samples by region:

Meshkin Shahr, Ardabil: 3 samples

Urmia, West Azerbaijan: 1 sample

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Behbahan, Khuzestan: 1 sample

Dehlran and Abdanan, Ilam: 2 samples

Sarein, Ardabil: 5 samples (the highest number of samples)

Saqqez, Kurdistan: 1 sample

East of Khuzestan, Khuzestan: 2 samples

Ajab Shir, East Azerbaijan: 1 sample

The most commonly used plant parts, in order of frequency, are:

Aerial organs: 5 samples

Fruits: 4 samples

Leaves and flowers: 2 samples

Other parts (e.g., seeds, roots, stems, leaves, bulbs): Only one occurrence each

Discussion

Hypertension, a prevalent global health concern, is characterized by elevated blood pressure exerting excessive force on arterial walls. This disease can occur due to aging or other diseases. The heart muscle weakens and endangers the health of organs such as kidneys, pancreas, and brain. In Mobarakeh city in Isfahan province (Iran), Rumex crispus L., Ziziphus jujuba (L) H. Karst, and Olea europaea L. are used to treat hypertension [16]. In the ethnobotanical knowledge of Arasbaran in northwestern Iran, medicinal plants Berberis vulgaris L., Achillea millefolium L., Ecbalium elaterium, Ribes orientale, Crataegus monogyna, Taxus baccata L. are blood pressure-lowering plants [17]. In the ethnobotanical knowledge of Sistan and Baluchestan, Nigella sativa L. is used to reduce blood pressure [18]. In the ethnobotanical knowledge of Kazerun city (southern Iran), medicinal plants Silybum marianum (L.) Gaerth, Achillea tenuifolia, Cichorium intybus, Silybum marianum, Berberis vulgaris, Capsella bursa-pastoris, Equisetum arvense, Juglans regia, Melilotus indicus are used to treat hypertension [19]. In Lorestan province (southwestern Iran), medicinal plants Morus alba, Falcaria vulgaris, Smyrnium Cordifolium, Crocus hasskenechtii, Berberis integrima, Ziziphus spina-christi, Ziziphus nummularia, Allium ursinum, Tragapogon caricifolius, Anethum graveolens, and Amygdalus scoparia are used to control and treat hypertension [20]. In Ilam province located in western Iran, Paliurus spina-christi and Rheum ribes L. are blood pressure-lowering plants [21].

Conclusion

A comparative analysis of ethnobotanical data from various Iranian regions revealed a diverse array of medicinal plants employed for hypertension management. While certain plant species were commonly utilized across different cultural contexts, unique regional variations in plant selection were evident. The present study identified several plants with potential antihypertensive properties, warranting further investigation to elucidate their underlying mechanisms of action and to explore their potential as novel therapeutic agents. These findings underscore the importance of preserving and documenting traditional knowledge for future drug discovery and development.

Statements and Declarations

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Competing interests

The authors have no competing interests to declare that are relevant to the content of this article.

Ethics approval

This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee of Urmia University of Medical sciences .

Consent to participate

Informed consent was obtained from all individual participants included in the study.

Author contributions

AM: Conceptualization, the original draft writing, investigation, writing including reviewing and editing and investigation and formal analysis; MP: Conceptualization, supervision, and project administration; AM and MP: Conceptualization, the original draft writing, investigation, writing including reviewing and editing

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