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Ethnobotanical Insights: Medicinal Plants of Northwest Iran in Diabetes Management

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A B S T R A C T

Objective: Diabetes mellitus is a widespread metabolic disorder and represents a significant global health challenge. The prevalence of diabetes is steadily increasing, making it a prevalent health condition worldwide. The prevalence of diabetes mellitus is notably high in Iran. Traditional Iranian medicine incorporates a diverse array of plants and minerals for the management of diabetes. This review aims to identify and evaluate the medicinal plants native to Northwest Iran that have been traditionally employed for the treatment of diabetes.

Methodology: This systematic review utilized a comprehensive search strategy to identify relevant literature on the use of medicinal plants for diabetes management in Northwest Iran. Authoritative scientific databases, including Google Scholar, SID, MagIran, PubMed, and Scopus, were systematically searched using the following keywords: 'medicinal plants,' 'Iran,' 'diabetes,' 'Urmia,' 'Tabriz,' 'Ardabil,' 'West Azerbaijan,' 'East Azerbaijan,' and 'ethnobotany.' The search results were filtered to include only ethnobotanical studies relevant to the research question.

Results: The review has highlighted the use of numerous medicinal plants, including *Apium graveolens*, *Alyssum desertorum*, *Arctium lappa*, *Avena sativa*, *Berberis integerima*, *Cerasus microcarpa*, *Crataegus aronia*, *Allium schoenoprasum*, *Urtica dioica*, *Phlomis aucheri*, *Salvia aethiopis*, *Melilotus officinalis*, *Tragopogon pratensis*, *Euphorbia helioscopia*, *Salvia officinalis*, *Salix aegyptiaca*, and many others, in the provinces of West Azerbaijan, East Azerbaijan, and Ardabil for the treatment of diabetes. These plant species have been traditionally used in the folk medicine of the region for their presumed antidiabetic properties.

Conclusion: The region of Northwest Iran possesses a rich tradition of ethnobotanical knowledge. The medicinal plants identified in this review warrant further investigation through rigorous clinical and pharmacological studies. If these plants demonstrate anti-diabetic effects, they could potentially serve as a valuable source for the development of novel anti-diabetic drugs.

Keywords: Chronic disease, diabetes, Medicinal plants, Traditional medicine, Northwest region, Iran

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Introduction

Diabetes mellitus is a prevalent metabolic disorder with a rising incidence worldwide, affecting both developed and developing nations [1]. The etiology of diabetes is multifaceted, involving a complex interplay of genetic, environmental, and lifestyle factors. While a familial predisposition may increase susceptibility, other individuals may develop diabetes due to unhealthy dietary habits, including excessive consumption of sugary and fatty foods. However, it is important to note that not all cases of diabetes can be attributed to these factors alone [2].

Diabetes mellitus is characterized by the body's inability to produce sufficient insulin or utilize it effectively. This insulin deficiency or resistance results in hyperglycemia, a condition where excess glucose accumulates in the bloodstream. Chronic hyperglycemia can lead to a range of

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serious complications, including an increased risk of Alzheimer's disease, diabetic foot ulcers, diabetic coma, oral and skin complications, diabetic neuropathy, retinopathy, nephropathy, ketoacidosis, cardiovascular disease, heart attack, and stroke [3-5].

Diabetes mellitus presents in several distinct forms, including type 2 diabetes, type 1 diabetes, pediatric-onset type 1 diabetes, prediabetes, and gestational diabetes [6]. Common symptoms associated with diabetes include polyuria, polydipsia, unexplained weight loss, polyphagia, blurred vision, paresthesia, chronic fatigue, xerosis, delayed wound healing, and an increased susceptibility to infections [7]. The development of diabetes often involves insulin resistance, a condition characterized by decreased sensitivity of muscle, liver, and fat cells to circulating insulin, resulting in impaired glucose uptake [8].

The development of diabetes is influenced by a complex interplay of factors, including insulin resistance, obesity, physical inactivity, poor diet, hormonal imbalances, genetic predisposition, autoimmune disorders, and pancreatic dysfunction [9].

Diagnostic testing for diabetes typically involves fasting blood glucose (FBG) measurements, oral glucose tolerance tests (OGTT), and glycated hemoglobin (HbA1c) assays [10]. A variety of medications, including insulin, acarbose, chlorpropamide, glyburide, gliclazide, metformin, pioglitazone, sitagliptin, tolazamide, dapagliflozin, and others, are employed to lower blood glucose levels and manage diabetes [11]. While these antidiabetic drugs are effective in controlling diabetes, they may be associated with adverse side effects [12].

Prior to the advent of insulin and conventional antidiabetic medications, herbal remedies and traditional treatments were historically employed to manage diabetes [13]. To date, over 1,200 medicinal plants have been documented worldwide for their potential to reduce blood glucose levels or mitigate diabetic complications [14]. Given the accessibility of plant resources, the generally lower incidence of side effects associated with herbal treatments, their widespread acceptance by patients, and the absence of restrictions on the production or importation of raw pharmaceutical materials, there is a compelling rationale for investigating effective herbal medicinal sources. This study aims to identify antidiabetic medicinal plants within the ethnobotanical knowledge of Northwest Iran.

Methodology

This review employed a comprehensive search strategy to identify relevant literature on the use of medicinal plants for diabetes management in Northwest Iran. Authoritative scientific databases, including Google Scholar, SID, MagIran, PubMed, and Scopus, were systematically searched using the following keywords: 'medicinal plants,' 'Iran,' 'diabetes,' 'Urmia,' 'Tabriz,' 'Ardabil,' 'West Azerbaijan,' 'East Azerbaijan,' and 'ethnobotany.' The search results were filtered to include only ethnobotanical studies relevant to the research question.

Results

A variety of medicinal plants, including Apium graveolens, Alyssum desertorum, Arctium lappa, Avena sativa, Berberis integerima, Cerasus microcarpa, Crataegus aronia, Allium schoenoprasum, Urtica dioica, Phlomis aucheri, Salvia aethiopis, Melilotus officinalis, Tragopogon pratensis, Euphorbia helioscopia, Salvia officinalis, and Salix aegyptiaca, are traditionally used in the West Azerbaijan, East Azerbaijan, and Ardabil provinces to treat diabetes. Additional information on antidiabetic medicinal plants within the ethnobotanical knowledge of Northwest Iran is provided in Table 1.

Table 1. Antidiabetic medicinal plants utilized in the ethnobotanical knowledge of Northwest Iran.

Scientific Name	Common Name	Plant Family	Part Used	Region Studied
Thymus sp.	Thyme	Lamiaceae	Aerial parts	Urmia, West Azerbaijan [15]

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Apium graveolens	Celery	Apiaceae	Leaves, stems	Urmia, West Azerbaijan [15]
Alyssum desertorum Stapf.	Hedge mustards	Brassicaceae	Seeds	Urmia, West Azerbaijan [15]
Arctium lappa L.	Burdock	Asteraceae		Urmia, West Azerbaijan [15]
Avena sativa L.	Oat	Poaceae	Fruit	Urmia, West Azerbaijan [15]
Berberis integerima Bunge.	Barberry	Berberidaceae	Fruit	Urmia, West Azerbaijan [15]
Cerasus microcarpa	Sour cherry	Rosaceae	Fruit	Urmia, West Azerbaijan [15]
C. colocynthis (L.) Schrad	Colocynth	Cucurbitaceae	Fruit	Urmia, West Azerbaijan [15]
Crataegus aronia (L.) Bosc ex Dc	Hawthorn	Rosaceae	Fruit	Urmia, West Azerbaijan [15]
Juglans regia	Walnut tree	Juglandaceae	Fruit, leaves	Urmia, West Azerbaijan [15]
Nasturtium officinalis (L.) R. Br.	Watercress	Cruciferae	Leaves, roots	Urmia, West Azerbaijan [15]
Papaver rhoeas L.	Poppy	Papaveraceae	Leaves	Urmia, West Azerbaijan [15]
Rumex sculantus L.	Sorrel	Polygonaceae	Fruit, leaves	Urmia, West Azerbaijan [15]
Trifolium pratense L.	Clover	Fabaceae	Flowering offshoot	Urmia, West Azerbaijan [15]
Sophora alopecuroides	Pagoda tree	Fabaceae	Inflorescence	Urmia, West Azerbaijan [15]
Allium schoenoprasum	Wild chives	Alliaceae	Leaves, bulb	Sareyn, Ardabil [16]
Urtica dioica	Nettle	Lamiaceae	Leaves	Sareyn, Ardabil [16]
Phlomis aucheri	Woolly mullein	Lamiaceae	Leaves, flowers	Sareyn, Ardabil [16]
Salvia aethiopis	Mediterranean sage	Lamiaceae	Leaves	Sareyn, Ardabil [16]
Melilotus officinalis	Yellow sweet clover	Fabaceae	Flowers	Sareyn, Ardabil [16]
Tragopogon pratensis	Goat's beard	Asteraceae	Roots, leaves	Ajab Shir, Azerbaijan [17]

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Euphorbia helioscopia L.	Sun spurge	Euphorbiaceae	Flowers, seeds	Meshginshahr, Ardabil [18]
Salvia officinalis L.	Sage	Lamiaceae	Roots, aerial parts	Meshginshahr, Ardabil [18]
Salix aegyptiaca L.	Musk willow	Salicaceae	Fruit, stems, leaves	Meshginshahr, Ardabil [18]
Urtica dioica L.	Nettle	Urticaceae	Leaves, roots, seeds	Meshginshahr, Ardabil [18]

Discussion

Disruptions in fundamental metabolic processes can result in impaired lipid, carbohydrate, and protein metabolism, ultimately contributing to the development of diabetes. If left unmanaged, diabetes can lead to significant damage to the visual, renal, cardiovascular, and nervous systems. This ethnobotanical review focuses on identifying medicinal plants that have been traditionally employed for the treatment of diabetes in Northwest Iran.

Traditional medicine in Shazand, Markazi Province, incorporates garlic (*Allium sativum*) and onion (*Allium cepa*) for the management of diabetes [19]. In Behbahan, *Cichorium intybus* and Hibiscus rosa-sinensis are employed to reduce blood glucose levels [20]. *Citrullus colocynthis* is used for diabetes control in Ilam Province [21]. Gentiana olivieri is applied for lowering blood sugar and managing diabetes in Saqqez, Kurdistan Province [22]. In Khuzestan Province, southwestern Iran, medicinal plants such as *Kelussia odoratissima*, *Arctium lappa*, *Brassica napus*, *Salvia officinalis*, *Morus alba*, and *Solanum nigrum* are utilized in the treatment of diabetes [23].

In Mobarakeh, Isfahan, central Iran, plants such as *Juglans regia*, *Hordeum vulgare*, *Cucurbita pepo*, *Coriandrum sativum*, and *Mentha spicata* are traditionally used for diabetes management. In the Arasbaran region, *Equisetum arvense* and *Rubus caesius* are employed for treating diabetes. In Abadeh, Shiraz, southern Iran, *Cichorium intybus* and *Achillea millefolium* are applied for diabetes treatment [26]. In Pasargad, *Dorema aucheri* is used to control blood sugar levels [27].

Conclusion

A diverse array of medicinal plants has been historically employed for the management of diabetes in various regions of Iran. The identification and documentation of these plant species within the context of local ethnobotanical knowledge is crucial for the development of effective and affordable herbal remedies for diabetes.

Statements and Declarations

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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.

Consent to participate:

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

Author contributions:

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

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