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Herbal treatments for diabetes mellitus in Algeria Province, Algeria: insights from patients and traditional healers

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Despite the widespread use of traditional phytotherapy in Algiers, the capital and most populated city of Algeria, ethnobotanical knowledge concerning antidiabetic medicinal plants in this urban region remains undocumented. Data were collected between October 2021 and August 2023 using semi-structured questionnaires covering socio-demographic characteristics, vernacular plant names, preparation methods, administration routes, and posology. Interviews were conducted with 161 diabetic patients (types 1 and 2), 25 herbalists, and 14 traditional healers residing in Algiers Province who agreed to participate; non-residents and unwilling informants were excluded. Plant species were identified from ethnobotanical literature and validated against The Plant List database; no voucher specimens were collected. Data were analysed using ethnobotanical indices, including Relative Citation Frequency (*RCF*) and Use Value (*UV*). We recorded 64 plant species belonging to 34 botanical families, with Lamiaceae most represented (12 species). Leaves (34.4%) and infusions (70.3%) were the predominant plant parts and preparation methods. Seven species -*Urticadioica*, *Eucalyptus globulus*, *Thymus vulgaris*, *Senna alexandrina*, *Melissa officinalis*, *Momordica charantia*, and *Rhamnus alaternus* -were used exclusively for type 2 diabetes. Notably, *Mentha piperita*, *Melissa officinalis*, and *Senna alexandrina* are mentioned here for the first time as antidiabetic remedies in Algeria. The most frequently cited species were *Oleaeuropaea* (*RFC* = 0.66), *Artemisia herba-alba* (0.49), and *Cinnamomum cassia* (0.405). Based on *UV*, *Laurus nobilis* was the highest value (3.85). This study provides the first ethnobotanical inventory of antidiabetic plants in Algiers Province, revealing rich traditional knowledge and critical safety awareness gaps. These findings contribute to preserving Algeria's intangible cultural heritage and offer a scientific basis for future pharmacological research on the use of plants to manage diabetes in North Africa.

Keywords: Algiers, Diabetes mellitus, Ethnobotany, Medicinal plants, Traditional medicine

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In Algeria, medicinal plants have long held great importance for the treatment of various diseases, including those affecting the respiratory system, skin, nervous system, liver, dermatological conditions, and urinary tract. However, digestive disorders are the most commonly treated with herbal therapy[1,2]. Herbal treatments for chronic diseases - such as cancer, hypertension, and diabetes - have also been reported in several regions of Algeria[1,3,4].

Diabetes is a serious public health problem. According to the International Diabetes Federation (IDF, 2025)[5], 589 million people worldwide are living with diabetes. In Algeria, approximately 4.76 million people were affected in 2025, representing 10.6% of the population aged 20-79 years. The IDF (2025) estimates the overall prevalence of diabetes among adults at 17.5%, justified by a sedentary lifestyle and rapid demographic change.

The use of medicinal herbs to treat diabetes is guided by multiple socio-economic, cultural, and environmental factors[6]. The World Health Organization (WHO, 2020) recognizes the benefits of traditional, complementary, and alternative medicine and encourages ethnobotanical and pharmacological research to develop improved plant-based medicines.

Although several ethnopharmacological studies have been conducted in Algeria, their number remains limited given the vastness of the territory (over 2 million km²), which is home to exceptional biodiversity and a wide diversity of ethnic and

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cultural groups. To date, only a few ethnobotanical studies have specifically focused on antidiabetic plants and involved a significant number of diabetic patients. In the Sidi Bel Abbès region (northwest of Algeria), an ethnobotanical survey conducted among 90 diabetic patients, Rih *et al.*[7] identified 20 medicinal plants belonging to 11 ethnobotanical families, in which *Olea europaea* L., *Rosmarinus officinalis* and *Artemisia herba-alba* Asso. were the most cited. In a survey conducted in Bouira (north-central Algeria) by Nouri *et al.*[8], among 43 plant species traditionally used by the local population to treat diabetes, *Olea europaea*, *Artemisia herba-alba* and *Moringa oleifera* were the most frequently cited. In the Tlemcen region (northwestern Algeria), Allali *et al.*[9] identified 58 plant species, with *Trigonella foenum-graecum*, *Citrullus colocynthis*, and *Saccocalyx satureioides* being the most frequently used. In various areas of northwestern and southwestern Algeria, Azzi *et al.*[10] documented 60 medicinal plants through interviews with 470 diabetic patients (266 of whom had type 2 diabetes); the most cited species were *Trigonella foenum-graecum*, *Rosmarinus officinalis*, and *Citrullus colocynthis*. In Souk Ahras district (northeastern Algeria), Bouzabata[11] identified 59 plant species traditionally used to treat diabetes, with *Oleaeuropaea*, *Ajugaiva*, *Myrtus communis*, and *Trigonella foenum-graecum* being the most commonly reported. Telli *et al.*[4] recorded 66 antidiabetic plant species in the Ouargla region (southeastern Algeria); the most frequently used were *Anvillea radiata*, *Ammodaucus leucotrichus*, *Artemisia herba-alba*, and *Citrullus colocynthis*. More recently, Bouzabata & Mahomoodally[12] conducted a survey across several areas in northeastern Algeria and documented 39 medicinal plants used in diabetes management, with *Artemisia herba-alba* Asso and *Olea europaea* L. being the most predominant.

In Algeria, traditional ethnobotanical knowledge faces increasing threats by rapid urbanization, socio-economic transformations, and weakening intergenerational transmission. In urban centres like Algiers, the shift to modern healthcare systems, coupled with the declining interest among younger generations in learning traditional healing practices, has led to a gradual erosion of indigenous knowledge systems. Furthermore, environmental pressures, particularly the overexploitation of medicinal plant species, further jeopardize the sustainability of these practices[13].

The lack of formal documentation exacerbates this vulnerability, as the knowledge held by aging traditional healers risks being lost forever upon their passing. These difficulties underscore the urgent need to systematically record and validate ethnobotanical knowledge before it disappears, particularly in densely populated urban regions where traditional practices coexist with modern medicine but remain largely unexplored by scientific research[14].

Algiers, the capital of Algeria, is a key region due to its strategic geographic location, cultural diversity, socio-economic importance, high population density, and widespread relianceon herbal medicine. Despite the high prevalence of diabetes in this urban context and the extensive use of herbal remedies, traditional knowledge of antidiabetic medicinal plants in Algiers has never been systematically documented scientifically.

This study therefore aims to fill this critical gap by providing the first comprehensive inventory and ethnobotanical analysis of medicinal plants used in diabetes management in Algiers Province. In doing so, it complements existing ethnobotanical studies conducted from other Algerian regions and contributes to a more complete understanding of the country's phytotherapeutic heritage.

Furthermore, this work represents a crucial step in preserving endangered traditional knowledge and unlocking the pharmacological potential of locally used species, thus providing a scientific basis for future drug discovery, safety assessment, and the evidence-based integration of herbal remedies into diabetes care.

Materials and Methods

Study area

The Wilaya of Algiers (Algiers Province) is an administrative subdivision of Algeria, centred on the city of Algiers (36°43′59″N, 3°04′29″E). It serves as the national capital and is bordered to the north by the Mediterranean Sea, to the east by the Wilaya of Boumerdès, to the south by the Wilaya of Blida, and to the west by the Wilaya of Tipaza (Fig. 1).

According to the official website of the Wilaya of Algiers, it is the most populous Wilaya in the country, with approximately 4 million inhabitants as of 2020, yet it is the smallest in terms of area, covering only 1,190 km². Administratively, the province comprises 57 communes grouped into 13 *daïras* (administrative districts).

Located in the Tell region of northern Algeria, the Wilaya of Algiers has a Mediterranean climate characterised by hot, dry summers and mild, wet winters, with occasional snowfall at higher elevations. Agricultural land in the Wilaya covers 37,209 hectares out of a total area of 80,922 hectars. The region also includes several forested areas, such as the forests of Ben Aknoun, Borrdj El Kifan, El Mouradia, Hydra, and Reghaïa[15]. Due to its strategy geographical location, the Wilaya of Algiers is a key crossroads between Europe, North Africa, and the Arab world, fostering intense commercial, cultural, and political exchange with numerous countries.

Conduct of the survey

This survey was conducted from October 2021 to August 2023 and covered nineteen major cities in the Wilaya of Algiers: Aïn Benian, Raïs Hamidou, Bouzareah, SidiM' Hamed, El Achour, Birkhadem, Mahelma, Rahmania, Douera, Saoula, Djasr Kasentina, Baraki, Bab Ezzouar, Sidi Moussa, Eucalyptus, Dar El Beïda, Rouïba, Reghaïa and Aïn Taya (Fig. 1).

The 19 towns surveyed in this study were selected using geographically stratified random sampling approach. The choice of towns was made randomly, while ensuring maximum geographical coverage of the province of Algiers. This strategy aimed to obtain a representative sample of the entire study area, minimize geographical biases, and capture the spatial heterogeneity of ethnobotanical knowledge within this densely populated urban region. Within each selected town, informants were recruited through combination random selection (at public health centres, medicinal plant markets, and community meetings) and snowball sampling (recommendations from initial participants), thus ensuring diverse representation in terms of age, sex, and socio-economic group. A total of 161 diabetic patients (type 1 and type 2), 25 herbalists, and 14 traditional healers were interviewed face-to-face using a semi-structured questionnaire. The interviews were conducted in French or Arabic, according to the interviewee's preference. The inclusion criteria were as follows: (1) Diagnosed diabetic patients (type 1 or type 2) with experience using traditional herbal remedies to manage their diabetes. (2) Traditional healers or herbalists practicing in the province of Algiers. (3) Permanent residents of the province of Algiers. (4) Age ≥ 18 years. The exclusion criteria were as follows: (1) Non-residents or temporary visitors to the province of Algiers. (2) Individuals refusing to provide informed consent. (3) Informants providing incomplete or inconsistent answers during the interview. (4) Individuals under the age of 18. (5) Patients with cognitive impairments affecting their ability to provide reliable information. This study was conducted in accordance with the ethical guidelines for ethnobotanical research established by the

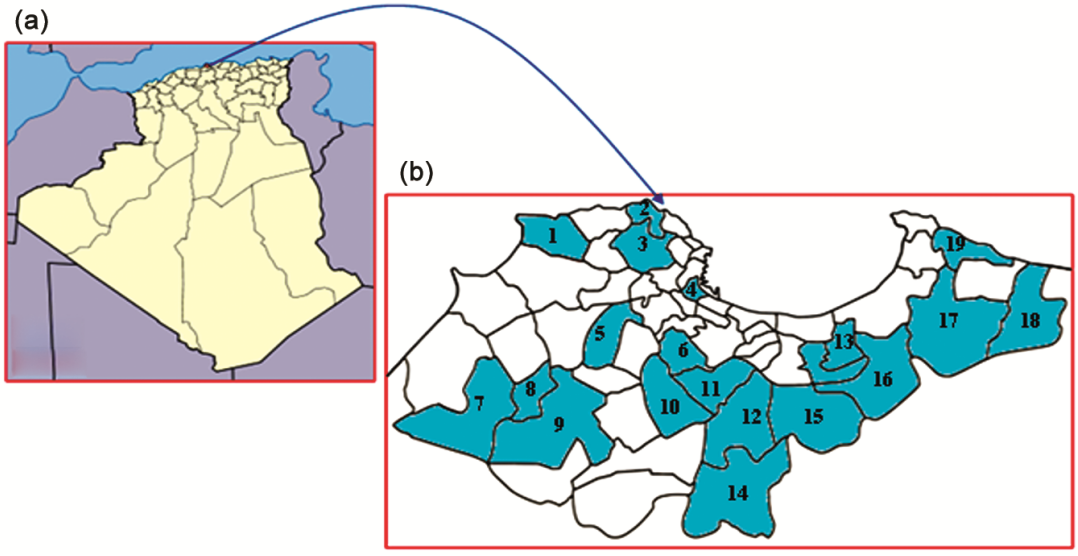

Fig. 1 — Map of the study area: (a) Algeria map; (b) Algiers Province, with the 19 surveyed towns. The numbered locations (1-19) correspond to the following surveyed towns: (1) Aïn Benian, (2) Raïs Hamidou, (3) Bouzareah, (4) SidiM' Hamed, (5) El Achour, (6) Birkhadem, (7) Mahelma, (8) Rahmania, (9) Douera, (10) Saoula, (11) Djasr Kasentina, (12) Baraki, (13) Bab Ezzouar, (14) Sidi Moussa, (15) Eucalyptus, (16) Dar El Beïda, (17) Rouïba, (18) Reghaïa, (19) Aïn Taya [Source: Carte-Algérie. Administrative map of Algeria. Available from: www.carte-algerie.com (accessed March 2024)]

International Society of Ethno botany (ISE Code of Ethics, 2006)[16]. At the time of data collection (2021-2023), formal ethical approval from an institutional ethics committee was not routinely required for observational ethnobotanical studies in our institution. Nevertheless, all fundamental ethical principles were rigorously applied: all participants were verbally informed of the study' sobjectives, procedures, potential risks, and benefits. Verbal informed consent was obtained from each participant before participation, in accordance with standard ethnobotanical practice in this cultural context. Participants were assured of their right to refuse to answer any questions or to withdraw from the study at any time, without any consequences. All data were anonymized; personal identifiers were removed during transcription and analysis to protect participants' privacy. The intellectual property rights of traditional healers and local communities regarding ethnobotanical knowledge were respected, and sensitive information was handled with the utmost care. Administrative authorization to conduct fieldwork in the province of Algiers was granted by the University of Boumerdès. An official authorization document was provided to each interviewee and to the local authorities to facilitate the research. All interviews were conducted in accordance with local cultural norms.

Meetings with herbalists and healers were arranged by visiting them at their practice locations. Patient recruitment was facilitated through intermediaries such as specialized clinics, pharmacists, doctors, other patients, and traditional healers. Social media platforms were also used occasionally too contact potential participants. The questionnaire included questions to collect socio-demographic data (sex, age, education level, etc.) as well as ethnobotanical information, including vernacular plant names, plant parts used, preparation methods, routes of administration, and dosage.

Plant identification

Plant species reported by informants were identified to the species level using a multi-step verification protocol to ensure taxonomic accuracy in the absence of voucher specimens. First, vernacular names (in Arabic or French) and morphological descriptions provided by informants were systematically cross-referenced with regional ethnobotanical studies[2,3,12,17] and reference books[18,19]. No voucher specimens were collected or taxonomically verified in the field; identification was based on previously published data. Second, the name of each plant was compared to The Plant List (TPL) database (www.theplantlist.org) to ensure nomenclatural accuracy. Third, when possible, photographs of plant material (leaves, flowers, fruits) available at local herbal markets were taken to facilitate visual identification. Finally, ambiguous cases were discussed with local botanists to reach a consensus on the species identification. All identified plants were compiled into a dedicated inventory of antidiabetic species, and each was assigned a herbarium code (MP/D).

Data analysis

The data collected were analysed using a combination of descriptive and quantitative ethnobotanical approaches:

Descriptive analysis

Interview data were first organized and summarized descriptively. Socio-demographic characteristics of informants (age, gender, education level, locality, occupation), clinical characteristics of patients, plant parts used (leaves, roots, seeds, bark, etc.), preparation methods (infusion, decoction, powder, maceration, etc.), routes of administration (oral, topical, inhalation, etc.), and therapeutic indications were tabulated and presented as frequencies and percentages. The medicinal plants documented in this survey were tabulated according to their botanical family, scientific name, local name, plant part used, preparation method, and primary therapeutic use.

Quantitative ethnobotanical analysis

To assess the relative importance of reported medicinal plant species and analyse patterns of traditional knowledge, the following quantitative ethnobotanical indices were calculated:

Relative frequency of citation (*RFC*)

The ethnobotanical importance of a given species was assessed using the Relative Frequency of Citation (*RFC*), calculated as follows[20]:

$$RFC=FC/N$$

Where *FC* is the number of informants who cited the species, and *N* is the total number of informants in the study.

Use value (*UV*)

The relative importance of each species was further evaluated using Use Value (*UV*), which identifies the most frequently cited plants for treating diabetes and

associated conditions. Participants were asked to report, in addition to antidiabetic use, any other therapeutic applications of the cited plants. UV was calculated using the formula proposed by Trotter and Logan[21]:

$UV=\Sigma Ui/N_T$

Where U_i is the number of use reports for a given species, and N_T is the total number of informants.

Percentage calculations

Certain results were expressed as percentages to facilitate comparison and interpretation. A percentage represents a ratio expressed as a fraction of 100, calculated by dividing the partial count (e.g., number of plants, patients, or citations) by the total number in the relevant category.

All statistical analyses and graphical representations were performed using Microsoft Excel (2010).

Results

Table 1 & Table 2, present selected demographic and clinical characteristics of the surveyed population. Among the 161 diabetic patients interviewed, 69.56% were diagnosed with non-insulin-dependent diabetes (NIDD, *i.e.,* type 2), 26.71% with insulin-dependent diabetes (IDD, *i.e.,* type 1), and 3.72% were not classified.

A total of 126 patients (78.3%) reported using herbal treatments for diabetes management, including 102 NIDD patients (63.4%) and 18 IDD patients (11.2%). Women constituted the majority of diabetic respondents (55.90%). In contrast, among the 39 traditional health practitioners (25 herbalists and 14 healers), men were predominant (74.35%).

Of the 40 IDD patients (24.84% of all patients), many combined herbal remedies with insulin therapy. Among NIDD patients, 86 (53.42%) used medicinal plants alongside conventional medications, while 26 (16.14%) relied exclusively on herbal treatments.

The data also indicate a positive association between herbal use and age: the proportion of plant users increased with age, with the highest usage reported in the over-60 age group (59.9%). Among practitioners, the most represented age group was 40-60 years (46.15%).

Finally, approximately 40% of patients reported diabetes-related complications. The most common was hypertension (17.39%, *i.e.,* 28 patients), followed by diabetic foot (11.18%, *i.e.,* 18 patients). For most complications, women were more frequently affected than men (Fig. 2). This descriptive trend, identified

Table 1 — Socio-demographic and clinical characteristics of the surveyed diabetic patients (n = 161) in Algiers Province

		Total	Men	Women
Patients		161(100)	71 (44.1)	90 (55.90)
Combination of plants with conventional medicines	NIDD	112 (69.56)	49 (30.43)	69 (42.85)
	PCM	86 (53.42)	37 (22.98)	49 (30.43)
	PNCM	26 (16.14)	14 (8.69)	12 (7.45)
	IDD	43 (26.7)	16 (9.94)	27 (16.77)
	PCM	40 (24.84)	17 (10.56)	23 (14.28)
	PNCM	3 (1.86)	3 (1.86)	0 (0.00)
	TNI	06 (3.72)	4 (2.48)	2 (1.24)
Old (year)	20-39	17 (10.56)	9 (5.59)	8 (4.97)
	40-60	54 (33.54)	26 (16.15)	28 (17.39)
	>60	90 (59.9)	36 (22.36)	54 (33.54)
	Average	53.66		
Education level	Illiterate	2 (1.24)	0 (0.00)	2 (1.24)
	Primary	9 (5.59)	3 (1.86)	6 (3.73)
	Average	19 (11.80)	11(6.83)	8 (4.97)
	Secondary	75 (46.58)	32 (24.22)	43 (26.71)
	Academic	56 (34.78)	25 (15.52)	31 (19.25)

Notes:*Percentages are given in parentheses; NIDD: Non-insulin-dependent diabetic patients; IDD: Insulin-dependent diabetic patients; TNI: Type not identified; PCM: Medicinal plants used in combination with conventional medicines; PNCM: Medicinal plants used without conventional medicines

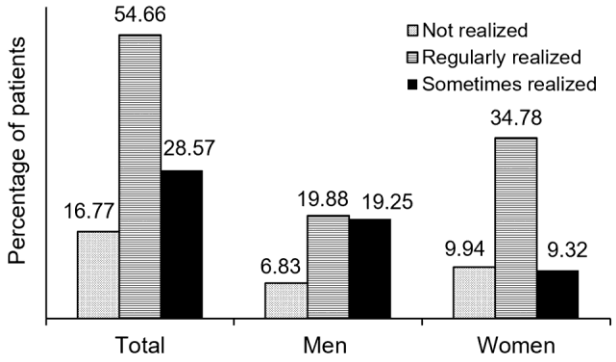

Fig. 2 — Prevalence of diabetes-related complications among surveyed patients in Algiers Province

Table 2 — Socio-demographic characteristics of the surveyed herbalists (n = 25) and traditional healers (n = 14) in Algiers Province

		Total	Men	Women
Professionals		39 (100)*	29 (74.36)	10 (25.64)
	Herbalists	25 (64.1)	18 (46.15)	7 (17.95)
	Healers	14 (35.89)	11 (28.21)	3 (7.69)
Old (year)	20-39	9 (23.07)	6 (15.38)	2 (5.13)
	40-60	18 (46.15)	15 (38.46)	3 (7.69)
	>60	12 (30.77)	7 (17.95)	5 (12.82)
	Average	13.00		
Education level	Illiterate	0 (0.00)	0 (0.00)	0 (0.00)
	Primary	0 (0.00)	0 (0.00)	0 (0.00)
	Average	6 (15.38)	2 (1.24)	4 (2.48)
	Secondary	21 (53.85)	16 (9.94)	5 (3.11)
	Academic	12 (30.77)	11 (6.83)	1 (0.62)

Notes: *Percentages are given in parentheses

through visual inspection of stratified age categories, is consistent with previous ethnobotanical studies in Algeria reporting greater reliance on traditional remedies among older populations[22,23].

Regarding educational level, the majority of diabetic patients had a secondary education (46.58%), followed by those with a university-level education (34.78%). Women were more highly represented than men (15.52%) among those with a university degree (19.25% of all patients). Among healthcare professionals, 53.85% had a secondary-level education and 30.77% held a university degree; none had a primary education or any formal education.

Glucose monitoring practices revealed that 83.23% of patients monitored their blood glucose levels. Of these, 28.57% did so occasionally, while 54.66% monitored regularly- with women exhibiting a higher rate of self-monitoring than men (Fig. 3).

Cited plant species and floristic analysis

The present survey documented 64 plant species traditionally used for the treatment of diabetes by participants in the Algiers region. As shown in (Table 3), the recorded species are listed with their botanical families, scientific names, local names, plant parts used, preparation methods, primary therapeutic uses, and additional ethnobotanical data.

A total of 32 botanical families were identified. The Lamiaceae family was the most represented, with 12 species (18.75% of the total), followed by Fabaceae and Asteraceae, each contributing 6 species (9.37%) (Fig. 4).

It should be noted that healers and herbalists confirmed the list of plants cited by patients and contributed additional species not initially mentioned by the patient group.

Among professionals, men cited more plant species than women (89.06% vs. 73.43%), whereas among patients, women reported a higher number of species than men (85.93%) (Fig. 5). This pattern likely reflects both the gender distribution within each group-men being predominant among practitioners and women among patients -and the distinct ethnobotanical knowledge traditionally associated with each gender in their respective roles.

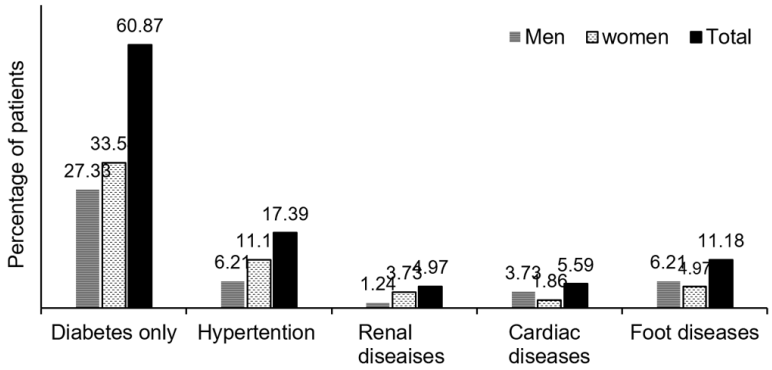

Fig. 3 — Distribution of surveyed diabetic patients in Algiers Province according to blood glucose monitoring practices

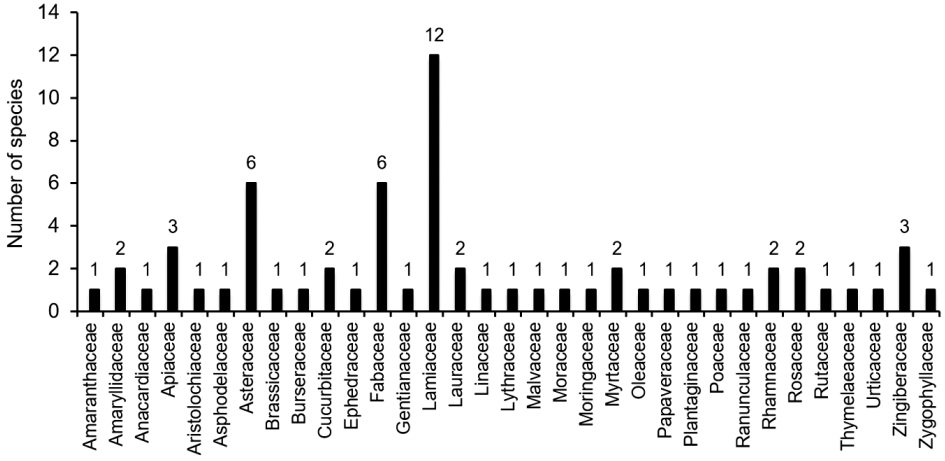

Fig. 4 — Distribution of antidiabetic plant species reported in this study across botanical families (n = 64 species, 34 families)

Table 3 — Medicinal plants used in the traditional management of diabetes in Algiers Province, northern Algeria

Name (Family)	Local name/Kind	PU	Method[(*)]	Ad	TD	*FC*	*RFC*	*UV*
Oleaeuropea L. (Oleaceae)	Zeyton/W,C	L	Decoction/Infusion: 1 cup twice a day, randomly	Orl	1 & 2	132	0.66	2.70
Artemisia herba-alba Asso (Asteraceae)	Chih/W	AP	Decoction/Infusion: 1 cup a day, randomly	Orl	1 & 2	98	0.49	1.41
Salvia officinalis L. (Lamiaceae)	Miramiya, kheyatledjrah/W	AP	Infusion: 1 cup a day, randomly	Orl	1 & 2	36	0.18	3.00
Cinnamomum cassia (L.) J.Presl (Lauraceae)	Keurfa/C	St	Decoction/Infusion: 1 cup a day, randomly	Orl	1 & 2	81	0.405	1.00
Trigonella foenum graecum L. (Fabaceae)	Halba/C	Sd	Decoction/Infusion: 1 cup three times a week, randomly	Orl	1 & 2	65	0.325	1.18
Moringa oleifera Lam. (Moringaceae)	Moringa/W	AP	Infusion: 1 cup a day, randomly	Orl	1 & 2	54	0.27	1.00
Ocimum basilicum L. (Lamiaceae)	Raihane/W	Fl	Infusion: 1 cup a day, randomly	Orl	1 & 2	22	0.11	1.00
Anthemis nobilis L. (Asteraceae)	Babounedj/W	AP, Fl	Infusion: 1 cup a day, randomly	Orl	1 & 2	14	0.07	1.00
Zingiber officinale Roscoe (Zingiberaceae)	Zanjabil/C	R	Decoction/Infusion: 1 cup twice a day; Powder: 2 teaspoons a day, after dinner	Orl	1 & 2	23	0.115	1.00
Centaurium erythraea Rafn (Gentianaceae)	Merartlehnache/W	AP	Infusion: 1 cup twice a day, randomly	Orl	1 & 2	14	0.07	2.29
Marrubium vulgare L. (Lamiaceae)	Meriwa/W	L	Infusion: 1 cup 1-3 times a days, after dinner or on an empty stomach	Orl	1 & 2	16	0.08	1.19
Lupinus pilosus L. (Fabaceae)	Tarmesseelmorr/W	Sd	Brute: 2 spoons a day, randomly	Orl	1 & 2	9	0.045	1.00
Ajugaiva (L.) Schreb. (Lamiaceae)	Chandegora/W	AP	Infusion, Maceration: 1 cup a day, randomly	Orl	1 & 2	14	0.07	1.21
Glycyrrhiza glabra L. (Fabaceae)	Eregassous/W	R	Infusion: 1 cup a day, randomly	Orl	1 & 2	4	0.02	1.25
Coriandrum sativum L. (Apiaceae)	Kosber/C	AP - Sd	Decoction/Infusion: 1 cup twice a day, after dinner	Orl	1 & 2	13	0.065	2.46
Aristolochia longa L.[(T)] (Aristolochiaceae)	Berrouztom/W	AP	Infusion: 1 cup a day, randomly	Orl	1 & 2	6	0.03	1.33
Boswellia carteri Birdw. (Burseraceae)	Loubanaddaker/W	Rn (dryed)	Infusion: 1 cup twice a day, on an empty stomach	Orl	1 & 2	8	0.04	1.00
Brassica oleracea L. (Brassicaceae)	Kromb/C	L	Decoction/Infusion: 1 cup a day/Cooking: 1-2 times a day, randomly	Orl	1 & 2	4	0.02	1.00
Linum usitatissimum L. (Linaceae)	NebtetElkettên/W	Sd	Infusion: 1 cup a day, randomly	Orl	1 & 2	5	0.025	1.00
Aquilaria malaccensis Lam. (Thymelaeaceae)	AoudGheriss/W,C	St	Infusion: 1 cup a day, randomly	Orl	1 & 2	7	0.035	1.00
Cynara cardunculus L. (Asteraceae)	Khourchef/C	St, L	Decoction/Infusion: 1 cup a day, randomly	Orl	1 & 2	2	0.01	1.00
Murraya koenigii (L.) Spreng. (Rutaceae)	Kari/C	L	Infusion:1 cup a day, randomly	Orl	1 & 2	2	0.01	1.00
Phaseolus vulgaris L. (Fabaceae)	Fassolyakhadra/C	Fr	Cooking: once a day, randomly	Orl	1 & 2	1	0.005	1.00
Gymnema sylvestre (Retz.) R.Br. ex Sm. (Fabaceae)	Jormar, jymnima/W	L	Iinfusion: 1 cup twice a day during 10 days, randomly	Orl	1 & 2	1	0.005	1.00
Pistacia lentiscus L. (Anacardiaceae)	Masteki, Dherw/W	Sd, L	Brute: 1 cup a day, on an empty stomach	Orl	1 & 2	3	0.015	1.00
Nigella sativa L. (Ranunculaceae)	Habasawda/C	Sd	Infusion: 1 cup a day, randomly	Orl	1 & 2	15	0.075	2.20
Hibiscus sabdariffa L. (Malvaceae)	Kerkadéa/C	Fl	Infusion/Decoction: 1 cup twice a day, after breakfast/after dinner	Orl	1 & 2	6	0.03	1.00
Laurus nobilis L. (Lauraceae)	Rend/C	L	Decoction: 1 cup a day, randomly	Orl	1 & 2	7	0.035	3.29
Aloe vera Mill. (Asphodelaceae)	Sebbar/W,C	WP	Brute: Once a day, randomly	Orl	1 & 2	2	0.01	1.00
Globularia alypium L. (Plantaginaceae)	Tasselgha/W	L	Infusion, 1 cup a day, randomly	Orl	1 & 2	5	0.025	1.00

… *Contd.*

Table 3 — Medicinal plants used in the traditional management of diabetes in Algiers Province, northern Algeria (*Contd*.)

Name (Family)	Local name/Kind	PU	Method(*)	Ad	TD	FC	RFC	UV
Allium sativum L. (Amaryllidaceae)	Thoum/C	B	Maceration: 1 cup twice a day, randomly	Orl	1 & 2	1	0.005	2.00
Rosmarinus officinalis L. (Lamiaceae)	Iklileljabal, Iklil/W	St,L	Infusion: 1cup 1-2 times a day, after lunch/after dinner	Orl	1 & 2	15	0.075	1.60
Prunus amygdalus var. amara (DC.) Focke(T) (Rosaceae)	Louzmorr/W,C	Sd	Brute: 1/2-1 seed a day, on an empty stomach	Orl	1 & 2	1	0.005	1.00
Curcuma longa L. (Zingiberaceae)	Kourkem/C	R	Maceration: 1 cup twice a day, Powder: 1 teaspoon a day, after dinner	Orl	1 & 2	6	0.03	1.00
Citrullus colocynthis (L.) Schrad. (Cucurbitaceae) (T)	Handel/C	Fr	Maceration: twice a day, randomly	EU	1 & 2	3	0.015	1.33
Artemisia absinthium L. (T) (Asteraceae)	ChadjaretMeriem/W,C	AP	Infusion/Decoction: 1 cup twice a day, randomly	Orl	1 & 2	14	0.07	1.00
Zygophyllum cornutum Coss. (Zygophyllaceae)	Aggaya, Akaya/W	L	Infusion: 1 cup twice a day, on an empty stomach/after dinner	Orl	1 & 2	4	0.02	1.00
Centaurea rigida Willd. (Asteraceae)	El merrar El kassi, Kentriyoun/W	L	Infusion: 1 cup a day, randomly	Orl	1 & 2	3	0.015	1.00
Rhamnus alaternus L. (T) (Rhamnaceae)	Mliless/W	L	Infusion: 1 cups 3 times a day, randomly	Orl	2	4	0.02	1.25
Allium cepa L. (Amaryllidaceae)	B'sel/C	B	Brute: twice a day, randomly	Orl	1 & 2	6	0.03	1.00
Apium graveolens L. (Apiaceae)	Krafess/W,C	AP	Maceration: 1 cup twice a day, randomly	Orl	1 & 2	13	0.065	2.38
Ephedra alata Decne. (Ephedraceae)	Aalenda, Aeulliga/W	L	Infusion: 1 cup a day, on an empty stomach	Orl	1 & 2	3	0.015	1.00
Stipa tenacissima L. (Poaceae)	Halfa/W	L	Infusion: 1 cup a day, after lunch/after dinner	Orl	1 & 2	2	0.01	1.00
Cynarac ardunculus var. *scolymus* (L.) Benth. (Asteraceae)	Karnon/C	Fl	Infusion: 1 cup a day, randomly	Orl	1 & 2	5	0.025	1.00
Momordica charantia L. (Cucurbitaceae)	karela, Elkerâelmorr/C	Fr, L	Infusion: 1 cup a day, randomly Brute	Orl	2	2	0.01	1.00
Elettaria cardamomum (L.) Maton (Zingiberaceae)	Hîl/C	Fr, Sd	Infusion: 1 cup a day, randomly; Brute	Orl	1 & 2	3	0.015	1.00
Syzygium aromaticum (L.) Merr. & L.M.Perry (Myrtaceae)	Kronfel/W,C	Fl	Infusion: 1 cup twice a day, randomly	Orl	1 & 2	3	0.015	1.00
Morus nigra L. (Moraceae)	Toute/W,C	L	Infusion: 1 cup a day, randomly	Orl	1 & 2	5	0.025	1.40
Mentha piperita L. (Lamiaceae)	Neanaa/C	AP	Decoction/Infusion: 1 cup 2-3 times a day, randomly	Orl	1 & 2	7	0.035	1.00
Melissa officinalis L. (Lamiaceae)	Habeke/C	AP	Decoction/Infusion: 1 cup 2-3 times a day, randomly	Orl	2	5	0.025	2.00
Pimpinella anisum L. (T) (Apiaceae)	Habethlawa, Yensoune/C	Sd	Powder: 2 teaspoons a day, on an empty stomach	Orl	1 & 2	8	0.04	1.38
Senna alexandrina Mill. (T) (Fabaceae)	Sana mekki/W	L	Infusion: 1 cup twice a day, after breakfast/after dinner	Orl	2	3	0.015	1.00
Mentha pulegium L. (Lamiaceae)	Fliyyou/W,C	AP	Infusion/Decoction: 1 cup a day, randomly	Orl	1 & 2	4	0.02	1.25
Origanum compactum Benth. (Lamiaceae)	Zaâter/W	AP	Infusion/Decoction: 1 cup 1 -2 times a day, randomly	Orl	1 & 2	10	0.05	1.40
Thymus vulgaris L. (Lamiaceae)	Zâitera/W,C	AP	Infusion/Decoction: 1 cup 1- 2 times a day, randomly	Orl	2	5	0.025	1.00
Eucalyptus globules Labill. (Myrtaceae)	Kalitouss/W	L	Infusion: Once a day, randomly	Orl,EU	2	2	0.01	1.50
Papaver rhoeas L. (Papaveraceae)	Benaaman/W	Fl	Infusion/Decoction 1 cup a day, randomly	Orl	1 & 2	7	0.035	1.29
Punica granatum L. (Lythraceae)	Roummân/C	Br	Decoction: 1 cup a day, randomly	Orl	1 & 2	12	0.06	1.00
Ziziphus lotus Lam. (Rhamnaceae)	Sedra/W	St, L	Decoction: 1 cups 1-3 times a day, randomly	Orl	1 & 2	7	0.035	1.00

… *Contd.*

Table 3 — Medicinal plants used in the traditional management of diabetes in Algiers Province, northern Algeria (*Contd*.)

Name (Family)	Local name/Kind	PU	Method(*)	Ad	TD	FC	RFC	UV
Crataegus laevigata (Poir.) DC. (Rosaceae)	Zaârour/C	L, Pu	Decoction: 1 cup 1-2 times a day, randomly	Orl	1 & 2	1	0.005	3.00
Urtica dioica L. (Urticaceae)	Hourrig/W	AP	Decoction: 1 cup a day, randomly	Orl	2	2	0.01	1.50
Lavandula stoechas L. (Lamiaceae)	Helhale/W	AP	Infusion/Decoction: 1 cup a day, randomly	Orl	1 & 2	7	0.035	1.29
Lavandula officinalis Chaix (Lamiaceae)	Khouzama/W	AP	Infusion/Decoction: 1 cup a day, randomly	Orl	1 & 2	5	0.025	1.00
Spinacia oleracea L. (Amaranthaceae)	Selk, Selg/W,C	L	Decoction: 1 cup 3 times a day, randomly	Orl	1 & 2	6	0.03	1.00

Notes:(T): Toxic plant *: Preparation method selected when only one mode was reported by informants, or when multiple similar methods (e.g. decoction versus boiling) were considered equivalent. • Origin: C: Cultivated; W: Wild. •Plant part used (PU): L: Leaves; AP: Aerial parts; St: Stem; Sd: Seeds; Fl: Flowers; Fr: Fruit; R: Root; Rn: Resin; Bu: Bulb; Br: Bark; Pu: Pulp; WP: Whole plant. •Ad: Route of administration (all oral, unless otherwise stated) • DT: Diabetes type: 1: Type 1 diabetes; 2: Type 2 diabetes • EU: External use • *FC*: Citation frequency (number of informants citing the species) • *RFC*: Relative Frequency of Citation (FC divided by total number of informants) • *UV*: Use Value

This list was verified and authenticated by the botanist Pr. Ait Kaki Sabrina, Department of Biology, University of Boumerdes

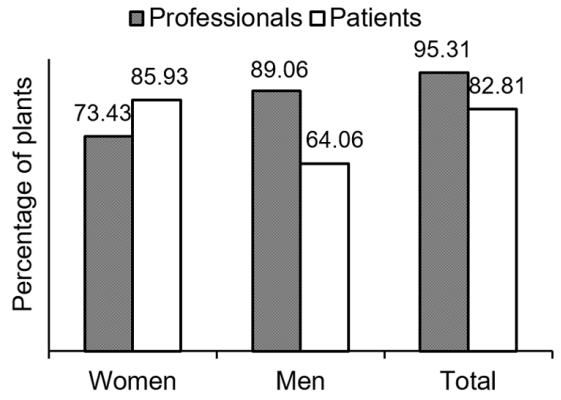

Fig. 5 — Influence of gender on the frequency of antidiabetic plant use among patients (n = 161) and traditional practitioners (n = 39) in Algiers Province

Based on relative frequency of citation (*RFC*) scores, the three most frequently used antidiabetic species in Algiers Province were: (i) *Olea europaea* L. (*RFC* = 0.66), (ii) *Artemisia herba-alba* Asso (*RFC* = 0.49), and (iii) *Cinnamomum cassia* (L.) *J. Presl* (*RFC* = 0.405).

Some of the cited species are exotic, such as *Moringa oleifera* Lam. and *Zingiber officinale* Roscoe, yet they exhibited relatively high *RFC* values (0.27 and 0.115, respectively).

According to use value (*UV*), *Laurus nobilis* L. (*UV* = 3.85) was the most cited species for treating diabetes and associated conditions, followed by *Olea europaea* L. (*UV* = 2.69)–further confirming its high ethnobotanical significance as an antidiabetic remedy–and *Coriandrum sativum* L. (*UV* = 2.46).

Statistical analysis revealed that approximately 56% of the cited plants were used exclusively for the treatment of diabetes. Among plants used for diabetes-related complications, renal disorders were the most commonly addressed (34.37%), followed by cardiovascular and foot complications (20.31% each). Additionally, 14% of the plants were also reported to treat hypertension.

Eight species (12.5% of the total) were used exclusively by patients with non-insulin-dependent diabetes (NIDD): *Urticadioica* L., *Eucalyptus globules* Labill., *Thymus vulgaris* L., *Senna alexandrina* Mill., *Melissa officinalis* L., *Momordica charantia* L., and *Rhamnus alaternus* L.

Comparison with the ethnobotanical literature

A review of the ethnobotanical literature revealed that three medicinal plants–*Mentha piperita* L., *Melissa officinalis* L., and *Senna alexandrina* Mill.–are reported here for the first time in the context of Algerian traditional medicine for the treatment of diabetes. Previous ethnopharmacological surveys conducted in Algeria have not documented the antidiabetic use of these species.

In the present study, these species exhibited the following Relative Frequency of Citation (*RFC*) values: *Mentha piperita*: 0.035, *Melissa officinalis*: 0.025 and *Senna alexandrina*: 0.015.

Their Use Values (*UV*) were 1.00, 1.38, and 1.00, respectively, indicating a notable level of ethnobotanical relevance despite their low citation frequencies. The aerial parts of *M. piperita* and *M. officinalis* are typically prepared as infusions or decoctions and consumed 2-3 times daily. In contrast, the leaves of *S. alexandrina* are used as an infusion, taken once per day (Table 3).

Toxic plants

Several cited plants –namely *Aristolochia longa* L., *Globularia alypum* L., *Prunus amygdalus* var. *amara* (DC.) Focke, *Citrullus colocynthis* (L.) Schrad., *Artemisia absinthium* L., *Rhamnus alaternus* L., *Pimpinella anisum* L., and *Senna alexandrina* Mill.–are considered toxic. However, the interviewees did not specify the level or nature of their toxicity. Therefore, these species should be used with caution in traditional medicine (Table 3).

Plant parts used and preparation methods

Various plant parts-such as stems, flowers, fruits, and roots- were reported for use against diabetes in the Wilaya of Algiers. However, leaves were the most frequently used plant part, cited for 34.37% of the species, followed by aerial parts (28.12%) and seeds (12.5%).

The identified antidiabetic plants were prepared using several methods, including maceration, powder, cooking, and decoction. Nevertheless, infusion was the predominant preparation method, used for 70.3% of the species, followed by decoction (37.5%). A small proportion of plants was consumed raw (9.0%) or prepared by maceration (7.8%). Methods involving powder or cooking were rarely employed.

All antidiabetic remedies were administered orally, which appear to be the most common and suitable route for managing this condition in the traditional context.

Antidiabetic effects of plants

For the majority of plant species cited in this study, antidiabetic effects -either *in vitro* or *in vivo* -have been previously demonstrated for various extracts in the scientific literature. Indeed, pharmacological evidence supports the traditional use of these medicinal plants in diabetes management.

This includes the most frequently cited species – *Olea europaea* L., *Artemisia herba-alba* Asso, and *Cinnamomum cassia* (L.) *J. Presl* -as well as *Mentha piperita* L., *Melissa officinalis* L., and *Senna alexandrina* Mill., which are reported here for the first time in the Algerian context for antidiabetic use.

Discussion

To our knowledge, this is the first comprehensive ethnobotanical survey documenting traditional of antidiabetic plants use in Algiers Province, Algeria. A total of 161 diabetic patients (type 1 and type 2), 25 herbalists, and 14 traditional healers were interviewed, allowing for the identification of 64 plant species belonging to 34 botanical families. Leaves were the most frequently used plant part (34.4%), and infusion was the predominant method of preparation (70.3%).

Comparative analysis with previous ethnobotanical studies

The predominance of non-insulin-dependent diabetes (NIDD) among respondents (69.56%) is consistent with the results from other Algerian regions, including Tlemcen[9], Souk Ahras[11], Ouargla[4], and north-eastern Algeria[12]. This trend can be explained by the fact that insulin-dependent diabetes (IDD) typically requires insulin treatment, which limits the use of herbal alternatives.

The overrepresentation of women among diabetic patients (55.9%) is consistent with studies conducted in Tlemcen[9], Naâma, El Bayadh and Adrar[10], Souk Ahras[11], Ouargla[4] and SidiBel Abbes[7]. This trend could reflect women's greater susceptibility to type 2 diabetes[9], their central role in family healthcare, and their generally more extensive knowledge of herbal medicine[14].

In contrast, the practice of herbalism was predominantly male in this study (74.35%), a trend also observed in the M'sila region[3]. However, a female dominance among healers was noted in other regions[1,17], highlighting the regional variability of gender roles within traditional medicine. The gender difference observed in this study reflects deeper socio-cultural patterns specific to the Algerian urban context. The male-dominated profile of professional herbalists echoes historical North African commercial traditions; where men generally manage public commercial spaces and the transmission of knowledge through the market. Conversely, the higher representation of women among patients using traditional remedies is explained by their traditional role as primary caregivers within the household. Women often accumulate practical knowledge about the use of plants for family health management, leading to greater understanding of home remedies[14]. In densely populated urban areas like Algiers, gender-segregated social networks can reinforce these distinct domains of knowledge, with men controlling the trade in medicinal plants and women preserving family medicinal knowledge. These dynamics underscore the importance of considering gender roles when documenting and preserving traditional ethnobotanical knowledge in urban settings.

The age group over 60 years exhibited the highest use of medicinal plants (59.9%), a higher proportion than reported in Ouargla[4] or northeastern Algeria[12].

This may reflect the accumulation of ethnobotanical knowledge with age[2]. Indeed, Rih *et al*.[7] noted that diabetes predominantly affects individuals aged 20-60 in the Algerian north oust.

Regarding education, university-educated women were well represented (19.25%), a finding comparable to that in Ouargla[4], where most patients had only primary or no formal education. The influence of educational level on herbal use varies across Algerian regions[1,3,24]. Notably, the proportion of academically trained herbalists in our study exceeds that reported by Boudjelal *et al*.[3]. Moreover, 54.66% of patients regularly monitored their blood glucose, a significantly higher rate than in Ouargla[4]. Nevertheless, this remains suboptimal, particularly given the potential risks of unsupervised herbal use, especially in type 1 diabetes[4].

The dominance of the Lamiaceae (12 species), followed by Fabaceae and Asteraceae (6 species each), mirrors patterns observed across Algeria[3,7,8,25]. This can be attributed to the high abundance of these families in the Algerian flora and the palatability of their sensory properties[14]. Similar trends are reported in Morocco[26], Ethiopia[27], and India[20].

Key species such as *Olea europaea* L. and *Artemisia herba-alba* Asso are frequently cited in northeastern Algeria[7,8,12]. *Cinnamomum cassia* (L.) J. Presl is also used in northwestern, southwestern, and southeastern Algeria[10,4].

Leaves -particularly of *O. europaea* -are the primary plant part used, typically prepared as infusions or decoctions, consistent with findings from multiple Algerian studies[10,11,28]. Similarly, A. *herba-alba* is used in various forms (leaves, aerial parts, roots, whole plant) via infusion, decoction, or powder 2.

Globally, leaves are the most frequently used part of the plant in herbal medicine, including in India[20], Ethiopia[27] and Morocco[29]. This preference is due to their year-round availability, ease of harvesting, and simple preparation. In contrast, roots, bark, and seeds are less used due to seasonal scarcity, low biomass yield, or environmental concerns related to destructive harvesting[3,11].

Although decoction is often cited as the main preparation method in Algeria[12], infusion predominated in our study. Both methods are widely used for antidiabetic remedies[1]. While infusion involves steeping the plant material in hot (not boiling) water, decoction requires prolonged boiling; both aim to extract bioactive compounds, and the choice between them often depends on the plant.

The preference for infusions in the province of Algiers may reflects the urban lifestyle and practical constraints of a densely populated city, where infusions offer greater ease of use, requiring less time and technical equipment than decoctions.

Furthermore, infusions are often perceived as safer for the long-term management of chronic diseases such as diabetes, as they extract fewer potentially toxic compounds than prolonged boiling. The high frequency of leafy plants observed in our study also naturally favours infusion, as this method is particularly well-suited to the tender parts of plants, while decoction is generally reserved for harder parts such as roots and bark. These results are consistent with observations from other urban ethnobotanical studies[3,12], suggesting that preparation methods are adapted to both the available plant parts and the socioeconomic context of the population.

Plants toxicity

Based on informants reports in this study, several species cited- *Aristolochia longa* L., *Globularia alypum* L., *Prunus amygdalus* var. amara (DC.) Focke, *Citrullus colocynthis* (L.) Schrad., *Artemisia absinthium* L., *Rhamnus alaternus* L., *Pimpinella anisum* L., and *Senna alexandrina* Mill.- are known or suspected to be toxic. However, none of the informants specified the dosage, preparation precautions, or risks of toxicity, highlighting a significant gap in knowledge. Toxicity is rarely addressed in Algerian ethnobotanical surveys. Bouzabata[11] is a rare exception, mentioning the toxicityy of *C. colocynthis*. Other studies report the antidiabetic use of *P. amygdalus* var. *Aristolochia amara*, *G. alypum*, A. *absinthium*, and *R. alaternus* were mentioned without specifying the risks[4]. Elyebdri *et al*.[30] also reported the toxicity of these species in Tlemcen.

Pharmacological studies confirm these toxicity concerns: (i) *Aristolochia longa* exhibits significant cytotoxicity[31]; (ii) extracts of *Rhamnus alaternus* exhibit hepatotoxic and nephrotoxic effects[32]; (iii) conversely, *Artemisia absinthium* showed no toxicity in Wistar rats at a dose ≤ 2%[33], and *S. alexandrina* proved safe in rabbits at a dose of 50 mg/kg/day for 4 weeks[34], although higher doses caused adverse effects.

These results highlight the urgent need for toxicological evaluation to establish safe doses, taking into account variables such as the plant part used, the method of preparation, the duration and frequency of use. Such data could inform evidence-based recommendations for traditional practitioners and patients.

Use of medicinal plants for other diseases

The surveyed plants are also used across Algeria to treat various ailments, with digestive disorders being the most common indication[1,2]. This includes both well-known species (*O. europaea*, *A. herba-alba*, *C. cassia*) and newly reported ones (*M. officinalis*, *M. piperita*, *S. alexandrina*)[35].

Antidiabetic effects of inventory plants

Numerous *in vitro* and *in vivo* studies support the traditional use of the most cited species:

Olea europaea

Ethanolic leaf extract (200-400 mg/kg for 10 weeks) reduced hyperglycemia and inflammation in streptozotocin (STZ)-induced diabetic rats[36]. Its antioxidant compounds (e.g., oleuropein) also ameliorated pancreatic and hepatic damage[37].

Artemisia herba-alba

Aqueous seed extract (100-400 mg/kg/day for 6 weeks) improved insulin sensitivity and lipid profiles in diabetic rats[38]. Leaf extract (400 mg/kg) showed nephroprotective effects in alloxan-induced diabetes[39].

Cinnamomum cassia

Polyphenol-rich extracts (200 mg/kg for 30 days) reduced blood glucose and improved lipid metabolism in STZ-diabetic rats[40].

Mentha piperita

Ethanol leaf extract (300 mg/kg for 45 days) and juice (0.29 g/kg for 21 days) significantly lowered blood glucose in diabetic rats[41].

Melissa officinalis

In a clinical trial, hydroalcoholic extract (700 mg/day for 12 weeks) significantly improved fasting glucose, β-cell function, triglycerides, and HDL-C in type 2 diabetic patients[42].

Senna alexandrina

Leaf extracts showed strong inhibition of α-glucosidase, α-amylase, and reduced oxidative stress and hepaticsteatosiin obese ratss[43].

These results strongly validate the ethnobotanical data and support further pharmacological research.

Active compounds

Traditional knowledge provides a vital foundation for drug discovery[44]. While phytochemical studies on Algerian antidiabetic plants remain limited, global research has identified numerous bioactive compounds-flavonoids, alkaloids, terpenes, tannins, phenolic compounds, coumarins, and glycosides-that exert antidiabetic effects by stimulating insulin secretion, β-cells regenerating, or insulin-mimetic activity[45].

Validation and limitations of traditional use

While herbal medicine offers valuable leads for pharmacological research, its traditional application is often limited by a lack of standardized dosing, preparation protocols, and toxicity awareness. From a methodological perspective, this study presents several limitations. First, the absence of voucher specimens constitutes a constraint often encountered in urban ethnobotanical context due to regulatory and logistical difficulties. This reliance on vernacular names alone carries a risk of plants misidentification. However, to ensure taxonomic accuracy, all identified species were cross-verified against authoritative botanical literature and regional floras, and consultations with local botanists experts were conducted whenever possible. Furthermore, during fieldwork, some knowledgeable healers refused to disclose plant names, considering them family secrets, which limited the completeness of the data. In addition, the low literacy levels of some participants and difficulties in patient recruitment constrained the sample size and the depth of the data. Despite these limitations, we believe the data presented provide a valuable foundation for understanding the traditional use of antidiabetic plants in the province of Algiers and highlight areas for future pharmacological and botanical research.

Conclusion

This study presents the first ethnobotanical documentation of antidiabetic medicinal plants in Algiers Province, Algeria, based on interviews with 161 patients, 25 herbalists, and 14 traditional healers. We identified 64 species belonging to 34 families; *Olea europaea*, *Artemisia herba-alba*, and *Cinnamomum cassia* were the most frequently cited. Leaves (34.4%) and infusions (70.3%) were the most predominate. Notably, *Mentha piperita*, *Melissa officinalis*, and *Senna alexandrina* were mentioned for the first time as antidiabetic remedies in Algeria, with seven species used exclusively for type 2 diabetes. Despite promising pharmacological evidence, several plants are potentially toxic, and yet safety recommendations are lacking. This work contributes to the preservation of intangible cultural heritage and encourages future research on safe, plant-based therapies for diabetes.

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We sincerely thank the holders of local knowledge -diabetic patients, herbalists, and traditional healers - for generously sharing their traditional botanical knowledge and insights. Their contributions were essential to this study. In accordance with ethical best practices in ethnobotanical research, a summary of the compiled findings will be translated into the local languages (Arabic and Tamazight) and shared with the participating communities as a gesture of respect and reciprocity.

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Author Contributions

All authors have read and approved the final version of the manuscript. NB and KH conducted the field survey and data collection; MT conceived the study, supervised the research, and led the writing of the original draft; SL and MT designed the methodological framework, performed data analysis, and contributed to the original draft; MT, SL, N.B., and KH participated in the critical revision and editing of the manuscript.

Conflict of Interest

The authors declare no actual or potential conflict of interest with respect to the research, authorship, and publication of this article.

Ethical Statement

This study was conducted in accordance with the International Society of Ethnobiology (ISE) Code of Ethics. At the time of data collection (2021-2023), formal institutional ethics committee approval was not systematically required for observational ethnobotanical research in Algeria. Administrative authorization was granted by the University of Boumerdès (September 2021). All participants provided informed verbal consent after being informed of the study objectives, procedures, and data use. Participation was voluntary, with the right to withdraw at any time without consequence. All data were anonymized to protect participant privacy, and traditional knowledge was respected without disclosing sensitive information (e.g., family-secret remedies) without explicit permission. The research complies with all applicable ethical standards, including the prohibition of plagiarism, data fabrication, falsification, scientific misconduct, and duplicate publication.

Informed Consent

All participants were informed about the purpose and scope of the study and voluntarily agreed to share their traditional knowledge. They also consented to the use of anonymized data for scientific publication.

Data Availability

All data generated and analysed during this study are included in this published article.

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