



# Ethnomedical practices and the dynamics of local Knowledge: participatory survey among populations in the Fez Meknes region

Meryem Doubi, Mostafa el Khomsi, Aimad Allali, Chaimae Torres, Youssef el Assri, Inssaf Amrani el Medrai, Nidal Khemmou, Amal Lahkimi, Driss Hmouni

## Correspondence

**Meryem Doubi<sup>1,2\*</sup>, Mostafa el Khomsi<sup>1</sup>, Aimad Allali<sup>2</sup>, Chaimae Torres<sup>1</sup>, Youssef el Assri<sup>2</sup>, Inssaf Amrani el medrai<sup>1</sup>, Nidal Khemmou<sup>3</sup>, Amal Lahkimi<sup>2</sup>, Driss Hmouni<sup>1</sup>**

<sup>1</sup>Laboratory of Natural Resources and Sustainable Development, Faculty of Sciences, Ibn Tofail University -KENITRA - University Campus, Kenitra 14000, Morocco

<sup>2</sup>Laboratory of Engineering, Electrochemistry, Modeling and Environment, Faculty of Sciences Dhar El Mahraz, Sidi Mohamed Ben Abdellah University, B.P. 1796 Atlas, Fez 30000, Morocco

<sup>3</sup>Laboratory of Advanced Materials and Process Engineering, Faculty of Sciences, University Ibn Tofail PB. 133- 14000, Kenitra, Morocco

\*Corresponding Author: meryem.doubi@uit.ac.ma

**Ethnobotany Research and Applications 34:13 (2026)** - <http://dx.doi.org/10.32859/era.34.13.1-23>

Manuscript received: 28/11/2025 - Revised manuscript received: 03/05/2026 - Published: 07/05/2026

## Research

### Abstract

**Background:** Medicinal and aromatic plants are essential for therapeutic, food, and cosmetic uses. Objectives: to promote local knowledge and document floral diversity and ethnobotanical practices.

**Methods:** An ethnobotanical survey (March 2024-March 2025) was conducted among 406 participants in Fez-Meknes Region, Morocco. The data, obtained from semi-open interviews on therapeutic, dietary, and cosmetic practices, were used to calculate Family Use Value (FUV), Use Value (UV), Plant Part Value (PPV), and Informant Agreement Ratio (IAR). Multiple correspondence analysis (MCA) explored the links between plant use and sociodemographic characteristics.

**Results:** 123 species belonging to 55 botanical families were enumerated, The Lamiaceae family (FUV=0.154) was found to be the most represented, while *Ajuga iva* (L.) Schreb. (UV=0.57) was the most recommended species. Maceration is the most common method of preparation (63.87%). Leaves are the most commonly used part (PPV=0.78). Painful and inflammatory conditions were the most frequently cited category (IAR=0.96).

**Conclusions:** Present study highlights the richness of flora and traditional knowledge, and the importance of phytochemical and pharmacological research in scientifically validating therapeutic, dietary, and cosmetic uses.

**Keywords:** Ethnopharmacology, Traditional medicine, Medicinal plants, Use value/IAR.

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## Background

Moroccan flora is among the richest and most diverse in the world, with around 4,200 species, 22% of which are endemic (Boudaia *et al.* 2024). Among them, nearly 800 species are used in traditional medicine (Amrati *et al.* 2021). This rich flora, fostered by the country's climatic and geographical diversity, has enabled the development of ancestral ethnobotanical knowledge passed down from generation to generation, playing an essential role in primary healthcare, nutrition, and cosmetics (Arraji *et al.* 2024, Tlemceni *et al.* 2023).

Recent ethnobotanical surveys confirmed that medicinal plants remain a fundamental pillar of traditional medicine in Morocco, particularly in rural areas where access to modern healthcare remains limited (El-Ghazouani *et al.* 2024, Yassara *et al.* 2025). In the Fez-Meknes region, several studies have highlighted significant species diversity, with digestive, inflammatory, and respiratory conditions among the most frequently treated with traditional remedies (Idrissi *et al.* 2025, Yassara *et al.* 2025). The most commonly represented botanical families are Lamiaceae, Apiaceae, Asteraceae, and Fabaceae, with a predominance of leaf use, often prepared as infusions or macerations (Benamar *et al.* 2025, Lefrioui *et al.* 2024, Salhi 2023).

Unlike previous studies, which were mainly descriptive, this study takes an approach focused on the sustainable use of local plant resources. By identifying the most commonly used species and assessing their medicinal, cosmetic, and food potential, it seeks to establish a link between traditional knowledge and prospects for local development and biodiversity conservation. This study therefore aims to inventory and analyze medicinal properties, cosmetic, and nutritional uses of plants in the Fez-Meknes region, while exploring the modes of transmission of local knowledge. This approach is part of an effort to promote and preserve ethnobotanical heritage, while contributing to the identification of plant resources of therapeutic interest and sustainable local development.

## Materials and Methods

### Study area

The Fez-Meknes region is located in north-central Morocco and comprises two prefectures (Fez-Meknes) and seven provinces (Taounate, Taza, Sefrou, El Hajeb, Boulmane, Moulay Yacoub, and Ifran) (Fig. 1). It is a region particularly endowed with great biological diversity and wealth of ancestral knowledge. It is known for its variety of ecosystems, ranging from fertile plains to mountainous areas, which are home to a diverse flora, including several medicinal and aromatic plants. For centuries, these plant resources have been used in cultural and therapeutic practices, demonstrating a valuable ethnobotanical richness that is still poorly documented scientifically.

This region has a wide variety of natural environments, which favors the presence of a significant wealth of flora. The selection of several provinces made it possible to compile a representative sample of local populations and their ethnobotanical knowledge, in both rural and urban areas, while considering geographical and cultural variations that may influence the use of MAPs (Ez Zoubi *et al.* 2022).

### Ethnobotanical survey

An ethnobotanical study was conducted in the Fez-Meknes region from March 2024 to March 2025. A semi-structured questionnaire was used and administered mainly online via the Google Forms platform and, when necessary, in person. By adopting the standard methodology represented by (El Rhaffari & Zaid 2002) and validated by members of the Natural Resources and Sustainable Development Laboratory, Faculty of Sciences Kenitra, Ibn Tofail University. Informants were advised that their contribution would assist in an ethnobotanical study conducted for exclusively scientific purposes and that their personal information would remain confidential. The main objective was to collect data on traditional knowledge relating to the practices of using medicinal plants in the region and determine their therapeutic and cultural applications.

The questionnaire for practitioners consisted of four main sections. The first section focused on personal information including sex, age, level of education and region. The second part concerned general knowledge about aromatic and medicinal plants, where practitioners shared their knowledge about these plants, their identification, and their availability. The third section addressed the practices and uses of aromatic and medicinal plants, exploring preparation methods, the parts of plants used, and therapeutic uses. Finally, the fourth section was dedicated to effectiveness and personal experiences, where practitioners were invited to give their opinion on the effectiveness of MAPs and share their experiences related to their use.

The sample of participants, selected at random from the study population in order to obtain a representative sample of the region's ethnobotanical knowledge, included men and women aged 26 to over 50. 240 women and 166 men out of a total of 406 informants were interviewed. The participants were individuals who use medicinal and aromatic plants for therapeutic, food, and/or cosmetic purposes (El-Assri et al. 2025).

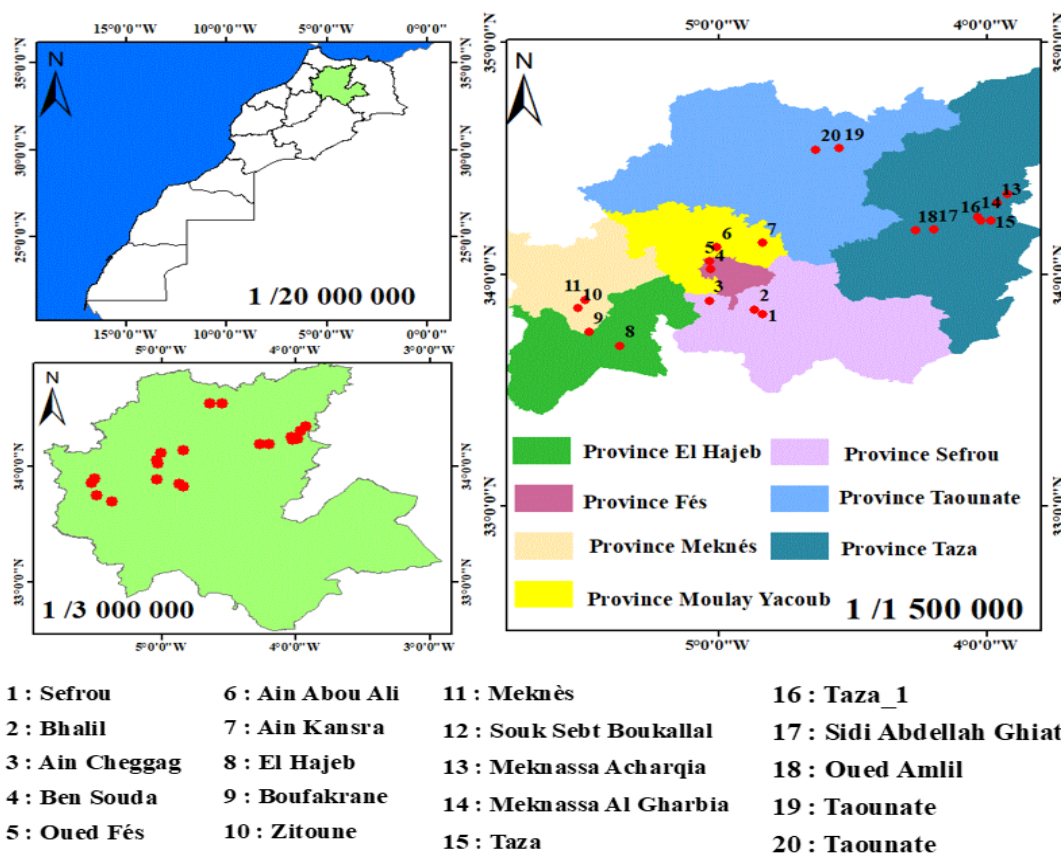


Figure 1. Map of Fez-Meknes region, Morocco, showing the study area.

#### Identification and preservation of plant species

The plants mentioned by the informants were identified at the Laboratory of Natural Resources and Sustainable Development, Department of Biology, Faculty of Sciences, Ibn Tofaïl University of Kenitra, Morocco, and using the following botanical works: Medicinal Plants in Morocco (Sijelmassi 1993) and the practical flora of Morocco (Fennane 1999). As well as recent articles from the same region (El-Assri *et al.* 2021, El Khomsi *et al.* 2022, Tlemcani *et al.* 2023).

#### Data Analysis

Socio-demographic data about participants were processed using descriptive and quantitative statistical methods (one-way ANOVA and independent sample t-test). The results are significant only if the p-value is less than or equal to 5%. To review the results obtained during the ethnobotanical survey, we used the Family Use Value (FUV), Use Value (UV), Plant Part Value (PPV), and Informant Agreement Ratio (IAR). Statistical analyses were performed using Statistical Package for Social Sciences (SPSS) version 20 and Microsoft Excel 2010.

#### Family use-value (FUV)

In order to assess the importance of botanical families, we used the FUV. This is a cultural importance index in ethnobotany to quantify the value of a biological taxon. To calculate the FUV, we used the following equation:

$$FUV = \frac{UV}{Ns}$$

UV is the number of informants mentioning the family, Ns is the total number of species in each family (Sreekeesoon & Mahomoodally 2014).

**Use Value (UV)**

Use value is a quantitative method that highlights the value of locally known species (Vitalini *et al.* 2012), was also calculated using the following formula:

$$UV = \frac{\sum UR}{N}$$

UR is the number of usage reports mentioned by each informant., N is the total number of informants interviewed for a given plant species.

**Plant Part Value (PPV)**

The Plant Part Value (PPV) was determined using the following formula (Gomez Beloz 2002):

$$PPV = \frac{RU}{RU \text{ plant part}}$$

RU is the number of reported uses of all plant parts; RU plant part represents the sum of reported uses per plant part. The part with the highest PPV is the most used by respondents.

**Informant agreement ratio (IAR)**

To calculate the IAR, we used the following equation (Heinrich *et al.* 1998, Trotter & Logan 1986):

$$IAR = \frac{Nur - Nt}{Nur - 1}$$

IAR is the informant agreement rate, Nur is the number of mentions in each category. The factor values range from 0 to 1.

**Multiple component analysis (MCA)**

Multiple component analysis (MCA) was performed using Jamovi software (version 2.6.26) to examine the relationships between the plants studied and the sociodemographic characteristics of respondents, including age, education level, gender, and marital status.

Being particularly suited to the analysis of qualitative variables, CMA required the transformation of certain quantitative variables into distinct qualitative classes, particularly those relating to age, gender, education level, and region.

Respondents were divided into the following categories:

- a. Age: 20-35 years, 36-50 years, 50 years and above
- b. Sex: Male & Female
- c. Education level: Illiterate, Primary, Secondary, University
- d. Region: Rural area or Urban area

Multiple component analysis (MCA) was chosen for this study because of its particular relevance to the analysis of categorical data, which constitutes the main type of information collected in our ethnobotanical survey. The dataset includes various qualitative variables related to the sociodemographic profiles of the participants (age, gender, level of education, region).

Multiple correspondence analysis (MCA) was used to examine the practices of using aromatic and medicinal plants among the study population, as well as their correlations with sociodemographic variables. This statistical approach highlights the influence of social and cultural factors on ethnobotanical knowledge and behaviors in the Fez-Meknes region.

Thus, this statistical approach is a relevant and effective method for highlighting how different sociodemographic groups relate to certain species or specific uses, providing a deeper understanding of local ethnobotanical practices.

Being specifically adapted to the analysis of qualitative variables, CMA required the prior transformation of quantitative variables such as the age of participants and the number of medicinal and aromatic plants (MAP) used into distinct qualitative classes, in order to ensure the robustness and consistency of the statistical analysis.

## Results

### Socio-demographic data of respondents

A total of 406 people were interviewed, 63,2% of whom were women and 36,8% men. 62,2% were over 50 years old, 19,3% were between 36 and 50 years old, 18,5% were between 20 and 35 years old. In terms of education level, most respondents were illiterate (30,1%) or had attended primary school (32,1%), while 22,5% had attended secondary school and 15,3% had attended university. The rural population was more prevalent (68,9%) than the urban population (31,1%). The results are presented in Table 1.

Table 1. Socio-demographic profile of respondents

Variable	Category	Total	Percentage (%)	P Value
Sex	Male	149	36,8%	< 0,0001*
	Female	259	63,2%	
Age	20-35 years	75	18,5%	< 0,0001*
	36-50 years	78	19,3%	
	50 years and above	252	62,2%	
Education level	Illiterate	122	30,1%	< 0,0001*
	Primary	130	32,1%	
	Secondary	91	22,5%	
	University	62	15,3%	
Region	Rural area	279	68,9%	< 0,0001*
	Urban area	126	31,1%	

The values with (\*) indicate a significant association between sociodemographic variables and the use of aromatic and medicinal plants ( $p < 0.05$ ).

### Age

The Fig. 2 shows a marked variation in the use of aromatic and medicinal plants (AMPs) according to age. The use of MAP increases with age, reaching its peak among people aged 50 and over (60.25%), followed by those aged 36-50 (16.79%) and 20-35 (13.58%).

Non-users are mainly young adults (aged 20-35: 4.94%), with their proportion decreasing among older people. This trend indicates a significant association between age and the use of MAPs, with older people favoring traditional remedies because of their experience and confidence in the effectiveness of plants, unlike younger people, who are more inclined towards modern medicine.

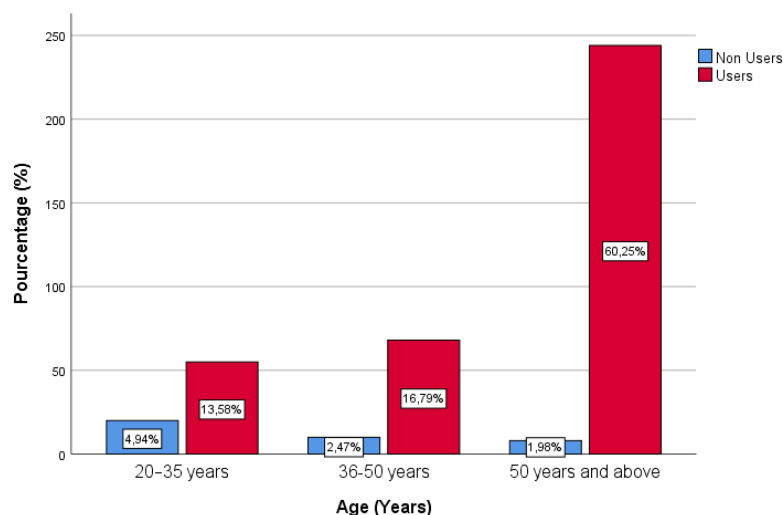


Figure 2. Distribution of respondents who use or do not use aromatic and medicinal plants, by age.

### Sex

Fig. 3 illustrates the distribution of aromatic and medicinal plant (MAP) use by gender. Women stand out with significantly higher use (240 users) compared to men (127 users). Conversely, the number of non-users is slightly higher among men (22) than among women (16).

These results highlight a statistically significant association between gender and the use of traditional medicines, suggesting that women make greater use of traditional remedies, probably due to their more active role in managing family health and passing on ethnobotanical knowledge.

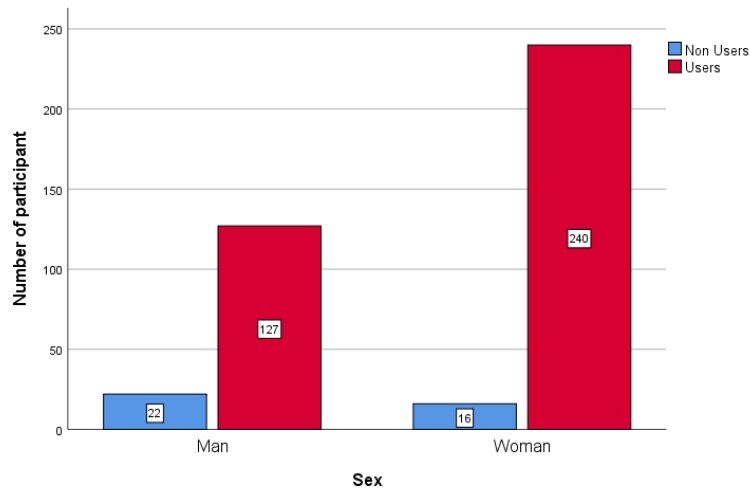


Figure 3. Distribution of respondents who use or do not use aromatic and medicinal plants, by gender.

#### Level of education

Fig. 4 shows that the use of aromatic and medicinal plants (MAP) varies according to level of education. Users are mainly illiterate (28.40%) or have completed primary education (31.60%), while this proportion decreases among people with secondary education (19.51%) or university education (11.11%).

Conversely, the proportion of non-users increases slightly with level of education, reaching 4.20% among university graduates. These results suggest a link between level of education and the use of traditional medicine, with less educated people remaining more attached to traditional practices, unlike those with higher qualifications, who are more inclined towards modern medicine.

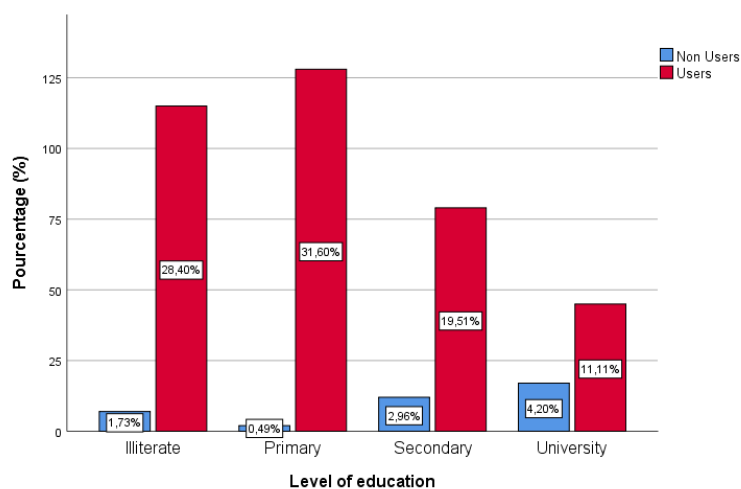


Figure 4. Distribution of respondents who use or do not use aromatic and medicinal plants according to level of education.

#### Participants' residential area

Fig. 5 reveals a marked difference in the use of aromatic and medicinal plants (MAPs) depending on place of residence. Rural residents account for the majority of users (63.95%), compared to only 26.67% in urban areas.

However, the proportion of non-users remains low and relatively similar between the two environments (4.94% in rural areas and 4.44% in urban areas). This trend shows that rural populations are more likely to maintain traditional practices related to medicinal plants, while those in urban areas use them less, probably due to easier access to modern healthcare.

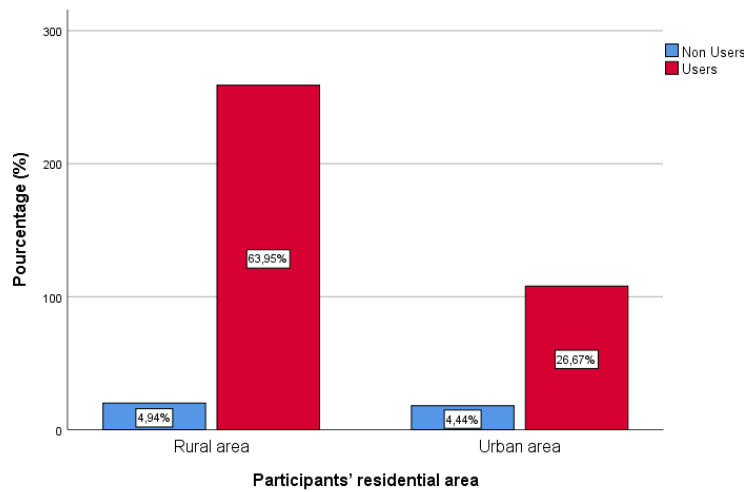


Figure 5: Distribution of respondents who use or do not use aromatic and medicinal plants, by region.

#### Multiple component analysis of collected data

The results of the Multiple Correspondence Analysis (MCA) are presented in Fig. 6. The first two axes, Dim1 (27.69%) and Dim2 (18.85%), together explain 46.54% of the total variance in the analyzed data. These axes made it possible to clearly distinguish individuals according to their sociodemographic characteristics and their use of medicinal and aromatic plants (MAPs).

Conversely, on the left side of the Dim1 axis are respondents who are illiterate or have a primary school education, live in rural areas, and belong to the older age group ( $\geq 50$  years). The latter have moderate to high use of MAPs, probably due to their attachment to traditional knowledge and their use of phytotherapeutic practices as an alternative to conventional medical care.

Axis 1 (Dim1) mainly differentiates participants according to their level of education, age, and place of residence. On the right side of this axis are people aged 20 to 35, living in urban areas and with a university education. These individuals are generally characterized by low or no use of traditional medicine, which could be explained by better access to modern healthcare and greater awareness of the risks associated with the uncontrolled use of traditional remedies.

Axis 2 (Dim2) highlights differences based on age and level of education. Individuals aged 36 to 50, generally with a secondary education, occupy an intermediate position, reflecting a mixed profile combining both knowledge of medicinal plants and openness to modern medicine.

With regard to gender, the MCA shows that women are mainly found in the group associated with rural areas and older age groups, highlighting their central role in the preservation and transmission preservation of ethnobotanical knowledge. Men, on the other hand, occupy a more central position, reflecting a more moderate or balanced involvement in the use of MAPs.

Overall, these results reveal that the practice of using medicinal and aromatic plants within the community of the Fez-Meknes region is strongly influenced by sociodemographic factors such as education level, age, gender, and place of residence. Less educated individuals and those from rural areas tend to use MAPs more, while young urban graduates favor modern treatments, illustrating a gradual transition between traditional and contemporary health practices.

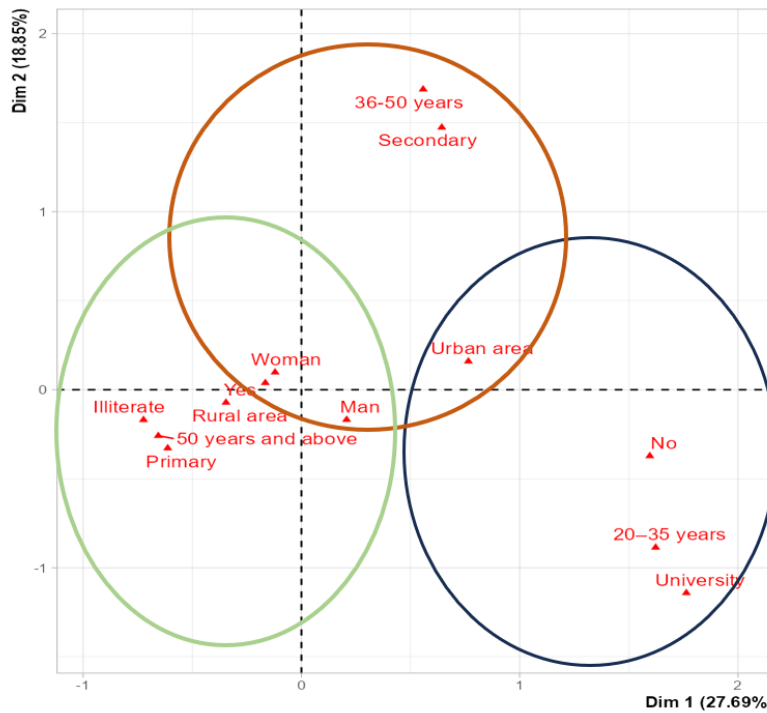


Figure 6. Biplot of multiple correspondence analysis (MCA) applied to the different variables relating to respondents.

**Ethnobotanical survey**

In our study, 123 medicinal plants belonging to 55 various botanical families were used in herbal medicine, phytocosmetics, and food by the local population. The Lamiaceae, Verbenaceae, Papaveraceae, and Fabaceae families were the most frequently mentioned families in this research. According to the FUV index, the most frequently cited families were Lamiaceae (FUV=0.154), Verbenaceae (FUV=0.118), and Papaveraceae (FUV=0.073). Furthermore, this study showed that *Ajuga iva* had the highest value (UV=0.57), followed by *Lavandula multifida* (UV=0.56), *Thymus vulgaris* (UV=0.27), and *Dittrichia viscosa* (UV=0.25) (Table 2).

Analysis of the data shows that the most frequently reported therapeutic uses relate to painful and inflammatory conditions (41.44%) and digestive disorders (40.02%). These categories are followed by boosting immunity and combating fatigue (8.32%), stress and sleep disorders (3.66%), and other miscellaneous uses (3.01%), while the lowest frequencies were recorded for respiratory conditions (2.8%) and skin problems (0.77%) (Fig. 7).

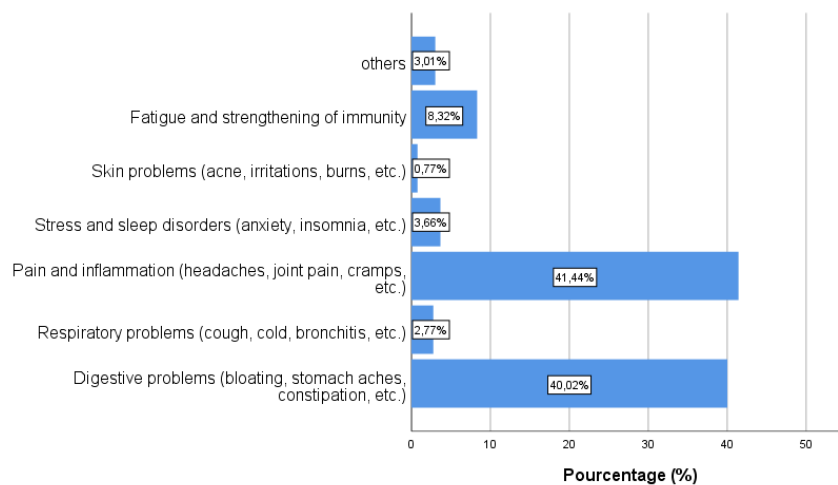


Figure 7. Frequency of the main categories of plant use.

### Informant Agreement Ratio (IAR)

The results of the IAR analysis are used to determine the most effective plants and determine the level of disease prevalence in the study area. The IAR values showed that the conditions most often reported by informants primarily concern strengthening immunity and combating fatigue, with a value of (0.96), as well as digestive disorders (0.94), followed by stress and sleep disorders (0.93), and painful and inflammatory conditions (0.92). Next come respiratory disorders and other conditions mentioned by informants, which had the same IAR value of (0.8), while skin problems had the lowest value (0.5) (Table 3).

### Parts of the plant used

The plant consists of several parts, each with therapeutic properties. According to the PPV index of the value of the parts of the plant, the leaves were cited as the part most used in preparations: leaves (PPV=0.78), followed by seeds (PPV=0.16), roots (PPV=0.03), stems (PPV=0.02) and others such as bulbs, rhizomes, etc. (PPV=0.01) (Fig. 8).

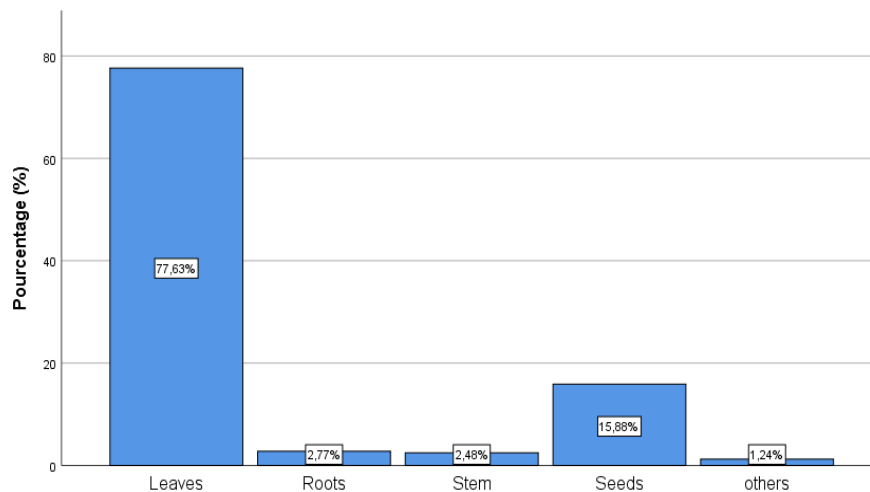


Figure 8. Part of the plant used for medicinal, food and cosmetic preparations.

### Preparation method

Statistical analysis reveals that maceration is the most common method (63.87%), followed by infusion (23.26%), then preparation by decoction (3.72%), compresses (3.60%) and other preparation methods (5.57%) (Figure 9).

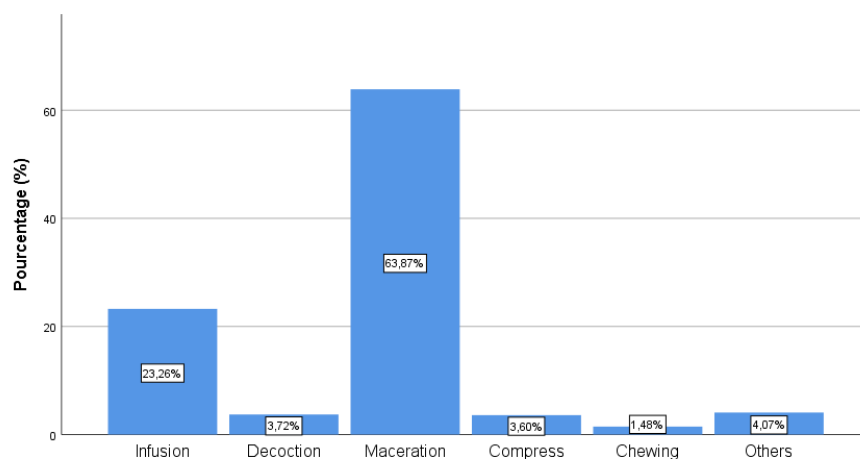


Figure 9. Percentage of different preparation methods.

Table 2. Medicinal plants used for therapeutic purposes.

Family	Species	Vernacular name	Part used	Method of use	Condition of the plant	Ethnobotanical uses	UR	UV	FUV
Anacardiaceae	<i>Pistacia atlantica</i>	Btem	Seeds	Maceration	Dry	Digestive problems (bloating, stomach aches, constipation, etc.)	37	0,091	0,048
	<i>Pistacia lentiscus</i>	Ad-Darrou	Leaves	Maceration	Dry	Pain and inflammation (headaches, joint pain, cramps, etc.)	2	0,005	
Amaryllidaceae	<i>Allium cepa</i>	Basla	Seeds	Maceration	Dry	Digestive problems (bloating, stomach aches, constipation, etc.)	5	0,012	0,014
	<i>Allium sativum</i>	Touma	Leaves	Maceration	Dry	Pain and inflammation (headaches, joint pain, cramps, etc.)	6	0,015	
Amaranthaceae	<i>Beta vulgaris</i>	Chmender	Leaves	Infusion	Dry	Pain and inflammation (headaches, joint pain, cramps, etc.)	2	0,005	0,009
	<i>Chenopodium album</i>	Beramram	Leaves	Maceration	Dry	Pain and inflammation (headaches, joint pain, cramps, etc.)	1	0,002	
	<i>Chenopodium ambrosioides</i>	Khnezzoua	Leaves	Maceration	Dry	Pain and inflammation (headaches, joint pain, cramps, etc.)	1	0,002	
	<i>Dysphania ambrosioides</i>	Mkhenza	Leaves	Compress	Costs	Respiratory problems (cough, cold, bronchitis, etc.)	14	0,034	
	<i>Haloxylon scoparium</i>	Rtham	Leaves	Compress	Dry	Pain and inflammation (headaches, joint pain, cramps, etc.)	1	0,002	
Apiaceae	<i>Ammi visnaga</i>	Bechnikha	Seeds	Infusion	Dry	Respiratory problems (cough, cold, bronchitis, etc.)	15	0,037	0,019
	<i>Apium graveolens</i>	Al-karfaz	Stem	Infusion	Costs	Digestive problems (bloating, stomach aches, constipation, etc.)	5	0,012	
	<i>Carum carvi</i>	Alkarwia	Seeds	Maceration	Dry	Pain and inflammation (headaches, joint pain, cramps, etc.)	12	0,030	
	<i>Coriandrum sativum</i>	Qezbour	Seeds	Maceration	Dry	Digestive problems (bloating, stomach aches, constipation, etc.)	10	0,025	

	<i>Cuminum cyminum</i>	Kamoun	Seeds	Maceration	Dry	Digestive problems (bloating, stomach aches, constipation, etc.)	1	0,002	
	<i>Ferula communis</i>	Boubale	Roots	Decoction	Dry	Pain and inflammation (headaches, joint pain, cramps, etc.)	6	0,015	
	<i>Foeniculum vulgare</i>	Basbasse	Seeds,Others	Maceration,Others	Dry,Costs	Digestive problems (bloating, stomach aches, constipation, etc.)	10	0,025	
	<i>Pastinaca sativa</i>	Left el mahfour	Seeds	Infusion	Costs	Respiratory problems (cough, cold, bronchitis, etc.)	1	0,002	
	<i>Petroselinum crispum</i>	Ma'danous	Leaves	Infusion	Dry	Pain and inflammation (headaches, joint pain, cramps, etc.)	8	0,020	
	<i>Pimpinella anisum</i>	Nafe	Seeds	Decoction	Dry	Digestive problems (bloating, stomach aches, constipation, etc.)	13	0,032	
	<i>Thapsia garganica</i>	Deryass	Roots	Decoction	Dry	Pain and inflammation (headaches, joint pain, cramps, etc.)	2	0,005	
	<i>Trachyspermum ammi</i>	Kamoun soufi	Seeds	Infusion	Dry	Digestive problems (bloating, stomach aches, constipation, etc.)	12	0,030	
Apocynaceae	<i>Nerium oleander</i>	Defla	Leaves	Compress	Dry	Pain and inflammation (headaches, joint pain, cramps, etc.)	5	0,012	0,012
Aquifoliaceae	<i>Ilex paraguariensis</i>	Matta	Leaves	Infusion	Dry	Digestive problems (bloating, stomach aches, constipation, etc.)	3	0,007	0,007
Asparagaceae	<i>Muscari spp</i>	Helhal	Leaves	Maceration	Dry	Pain and inflammation (headaches, joint pain, cramps, etc.)	1	0,002	0,002
Arecaceae	<i>Chamaerops humilis</i>	Alghaz	Seeds	Maceration	Dry	Pain and inflammation (headaches, joint pain, cramps, etc.)	1	0,002	0,025
	<i>Hyphaene thebaica</i>	Doum	Seeds	Decoction	Dry	Digestive problems (bloating, stomach aches, constipation, etc.)	19	0,047	

Asphodelaceae	<i>Aloe vera</i>	Sabar	Seeds	Infusion	Dry	Pain and inflammation (headaches, joint pain, cramps, etc.)	1	0,002	0,002
Asteraceae	<i>Anacyclus pyrethrum</i>	Takendicht	Roots	Compress	Dry	Pain and inflammation (headaches, joint pain, cramps, etc.)	4	0,010	0,043
	<i>Armoise commune</i>	Chih	Leaves	Maceration	Dry	Digestive problems (bloating, stomach aches, constipation, etc.) & Pain and inflammation (headaches, joint pain, cramps, etc.)	36	0,089	
	<i>Artemisia absinthium</i>	Chiba	Leaves	Infusion	Costs	Fatigue and immune system support	20	0,049	
	<i>Artemisia herba-alba</i>	Taghighacht	Leaves	Decoction	Dry	Pain and inflammation (headaches, joint pain, cramps, etc.)	2	0,005	
	<i>Calendula officinalis</i>	Jemra	Others	Infusion	Dry	Pain and inflammation (headaches, joint pain, cramps, etc.)	1	0,002	
	<i>Camomille allemande</i>	Babounj	Leaves	Infusion	Dry	Digestive problems (bloating, stomach aches, constipation...)	54	0,133	
	<i>Carduus pycnocephalus</i>	Chouk Ihemir	Leaves	Infusion	Dry	Digestive problems (bloating, stomach aches, constipation, etc.) & Pain and inflammation (headaches, joint pain, cramps, etc.)	3	0,007	
	<i>Carduus pycnocephalus</i>	Timet	Leaves	Maceration	Dry	Digestive problems (bloating, stomach aches, constipation, etc.) & Pain and inflammation (headaches, joint pain, cramps, etc.)	2	0,005	
	<i>Carlina acaulis</i>	Dad	Roots	Others	Dry	Others	12	0,030	
	<i>Cynara scolymus</i>	Kharchouf beldi	Roots	Maceration	Dry	Digestive problems (bloating, stomach aches, constipation...)	2	0,005	
<i>Dittrichia viscosa</i>	Magramane	Leaves	Maceration	Dry	Digestive problems (bloating, stomach aches, constipation...)	100	0,246		
<i>Rhaponticum acaule</i>	Tafgha	Roots	Infusion	Dry	Pain and inflammation (headaches, joint pain, cramps, etc.)	2	0,005		

	<i>Saussurea costus.</i>	Al-Qist Al-Hindi	Roots	Decoction	Dry	Pain and inflammation (headaches, joint pain, cramps, etc.)	1	0,002	
	<i>Scolymus hispanicus</i>	Garnina	Stem	Maceration	Dry	Pain and inflammation (headaches, joint pain, cramps, etc.)	3	0,007	
Berberidaceae	<i>Leontice leontopetalum</i>	Aslouje	Stem	Chewing	Costs	Digestive problems (bloating, stomach aches, constipation...)	1	0,002	0,002
Boraginaceae	<i>Borago officinalis</i>	Lisan Ath-Thawr	Leaves	Maceration	Dry	Pain and inflammation (headaches, joint pain, cramps, etc.)	1	0,002	0,002
Brassicaceae	<i>Anastatica hierochuntica</i>	Kef-maryam	Roots	Infusion	Dry	Pain and inflammation (headaches, joint pain, cramps, etc.)	4	0,010	0,009
	<i>Armoracia rusticana</i>	Left elmahfour	Seeds	Others	Costs	Pain and inflammation (headaches, joint pain, cramps, etc.)	5	0,012	
	<i>Eruca sativa</i>	Jirjir	Leaves	Maceration	Dry	Digestive problems (bloating, stomach aches, constipation...)	1	0,002	
	<i>Lepidium sativum</i>	Hab Rchad	Seeds	Maceration	Dry	Pain and inflammation (headaches, joint pain, cramps, etc.)	1	0,002	
	<i>Nasturtium officinale</i>	Grnunech	Leaves	Chewing	Costs	Digestive problems (bloating, stomach aches, constipation...)	1	0,002	
	<i>Raphanus raphanistrum</i>	Aslouj	Stem	Chewing	Costs	Digestive problems (bloating, stomach aches, constipation...)	1	0,002	
	<i>Raphanus sativus</i>	Fjel	Seeds	Infusion	Costs	Digestive problems (bloating, stomach aches, constipation...)	12	0,030	
Cactaceae	<i>Opuntia ficus-indica</i>	Sabbar	Others	Others	Costs	Digestive problems (bloating, stomach aches, constipation...)	6	0,015	0,015
Capparaceae	<i>Capparis spinosa</i>	Lkebbâr	Seeds	Chewing	Dry	Digestive problems (bloating, stomach aches, constipation...)	1	0,002	0,002
Caryophyllaceae	<i>Herniaria hirsuta</i>	Herasst leher, Zarzar	Leaves	Maceration	Dry	Pain and inflammation (headaches, joint pain, cramps, etc.)	8	0,020	0,020
Cucurbitaceae	<i>Citrullus colocynthis</i>	Handel	Seeds	Maceration	Dry	Pain and inflammation (headaches, joint pain, cramps, etc.)	1	0,002	0,002

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Cupressaceae	<i>Juniperus</i> spp.	Arâar	Leaves	Maceration	Dry	Digestive problems (bloating, stomach aches, constipation, etc.)	6	0,015	0,009
	<i>Cupressus sempervirens</i>	Sarw	Seeds	Maceration	Dry	Digestive problems (bloating, stomach aches, constipation...)	1	0,002	
Cuscutaceae	<i>Cuscuta campestris</i>	Hamoul	Stem	Maceration	Dry	Pain and inflammation (headaches, joint pain, cramps, etc.)	1	0,002	0,002
Cyperaceae	<i>Cyperus esculentus</i>	Bak Bouka	Roots	Others	Dry	Others	1	0,002	0,002
Euphorbiaceae	<i>Acalypha indica</i>	Bareztem	Leaves	Maceration	Dry	Pain and inflammation (headaches, joint pain, cramps, etc.)	11	0,027	0,025
	<i>Euphorbia resinifera</i>	Daghmous	Stem	Maceration	Costs	Pain and inflammation (headaches, joint pain, cramps, etc.)	4	0,010	
	<i>Ricinus communis</i>	Kharwaâ	Seeds	Others	Dry	Others	15	0,037	
Fabaceae	<i>Ceratonia siliqua</i>	Al-Kharrub	Seeds	Maceration	Dry	Digestive problems (bloating, stomach aches, constipation...)	1	0,002	0,008
	<i>Genista clavata</i>	Rtem	Leaves	Maceration	Dry	Pain and inflammation (headaches, joint pain, cramps, etc.)	5	0,012	
	<i>Glycyrrhiza glabra</i>	Eirq sus	Roots	Maceration	Dry	Digestive problems (bloating, stomach aches, constipation...)	1	0,002	
	<i>Lupinus albus</i>	Termis	Seeds	Chewing	Costs	Digestive problems (bloating, stomach aches, constipation...)	1	0,002	
	<i>Medicago sativa</i>	El-fassa	Leaves	Infusion	Dry	Digestive problems (bloating, stomach aches, constipation...)	1	0,002	
	<i>Trigonella foenum-graecum</i>	Halba	Seeds	Chewing	Dry	Digestive problems (bloating, stomach aches, constipation...)	11	0,027	
Geraniaceae	<i>Pelargonium graveolens</i>	Atrcha Maaterssa	Leaves	Compress	Costs	Pain and inflammation (headaches, joint pain, cramps, etc.)	5	0,012	0,006
Iridaceae	<i>Crocus sativus</i>	Zaafrene	Others	Infusion	Dry	Stress and sleep disorders (anxiety, insomnia...)	6	0,015	0,015
Lamiaceae	<i>Ajuga iva</i>	Chantkoura	Leaves	Maceration	Dry	Pain and inflammation (headaches, joint pain, cramps, etc.)	231	0,569	0,154

	<i>Lavandula angustifolia</i>	Khouzama	Leaves	Maceration	Costs	Fatigue and immune system support	39	0,096	
	<i>Lavandula multifida</i>	Kahila	Leaves	Maceration	Dry	Digestive problems (bloating, stomach aches, constipation...)	226	0,557	
	<i>Marrubium vulgare</i>	Mersita	Leaves	Infusion	Dry	Digestive problems (bloating, stomach aches, constipation...)	35	0,086	
		Merriwta							
		Mchachro							
	<i>Mentha pulegium.</i>	Fliyou	Leaves	Maceration	Dry	Digestive problems (bloating, stomach aches, constipation...) & Respiratory disorders (cough, cold, bronchitis...)	23	0,057	
	<i>Mentha spicata.</i>	Na'na'	Leaves	Infusion	Costs	Digestive problems (bloating, stomach aches, constipation...) & Stress and sleep disorders (anxiety, insomnia...)	45	0,111	
	<i>Mentha suaveolens</i>	Timijja	Leaves	Infusion	Dry	respiratory problems (cough, cold, bronchitis, etc.)	2	0,005	
	<i>Ocimum basilicum</i>	Rayhan	Leaves	Infusion	Dry-Costs	Pain and inflammation (headaches, joint pain, cramps, etc.) & Others	14	0,034	
		Lhabq							
	<i>Origanum majorana</i>	Mardadoush	Stem	Infusion	Costs	Digestive problems (bloating, stomach aches, constipation...)	14	0,034	
	<i>Origanum vulgare</i>	Zaitra	Leaves	Maceration	Dry	Pain and inflammation (headaches, joint pain, cramps, etc.)	25	0,062	
	<i>Salvia officinalis</i>	Salmiya	Leaves	Maceration	Dry	Pain and inflammation (headaches, joint pain, cramps, etc.)	51	0,126	
		Maramia							
	<i>Salvia rosmarinus</i>	Azir	Leaves	Maceration	Dry	Pain and inflammation (headaches, joint pain, cramps, etc.)	59	0,145	
	<i>Teucrium polium</i>	Khayata	Leaves	Compress	Costs	Skin problems (acne, irritations, burns...)	2	0,005	
		Jaâda							
	<i>Thymus vulgaris</i>	Zaater	Leaves	Infusion	Dry-Costs	Pain and inflammation (headaches, joint pain, cramps, etc.)	111	0,273	
Lauraceae	<i>Cinnamomum verum</i>	Karfa	Stem	Infusion	Dry	Stress and sleep disorders (anxiety, insomnia...)	8	0,020	0,032
	<i>Laurus nobilis</i>	Werket sidna moussa	Leaves	Maceration	Dry	Digestive problems (bloating, stomach aches, constipation,	18	0,044	

		Warka l-ghar				etc.) & Pain and inflammation (headaches, joint pain, cramps, etc.)			
Linaceae	<i>Linum usitatissimum</i>	Zariat el katane	Seeds	Maceration	Dry	Digestive problems (bloating, stomach aches, constipation...)	3	0,007	0,007
Lythraceae	<i>Lawsonia inermis</i>	Hnna	Leaves	Others	Dry	Others	2	0,005	0,005
Malvaceae	<i>Hibiscus fragilis</i>	Carcadet	Leaves	Maceration	Dry	Skin problems (acne, irritations, burns...)	2	0,005	0,006
	<i>Malva sylvestris</i>	Khubbayza	Leaves	Others	Costs	Others	3	0,007	
Mobulidae	<i>Mobula birostris</i>	Manta	Leaves	Maceration	Dry	respiratory problems (cough, cold, bronchitis, etc.)	1	0,002	0,002
Moraceae	<i>Ficus carica</i>	Kermous	Leaves	Maceration	Dry	Digestive problems (bloating, stomach aches, constipation...)	1	0,002	0,002
Myristicaceae	<i>Myristica fragrans</i>	gouza	Seeds	Maceration	Dry	Skin problems (acne, irritations, burns...)	1	0,002	0,002
Myrtaceae	<i>Eucalyptus globulus</i>	Kalyptus	Leaves	Infusion	Dry	Respiratory problems (cough, cold, bronchitis, etc.)	3	0,007	0,016
	<i>Myrtus communis</i>	Al-As	Leaves	Infusion	Dry	Pain and inflammation (headaches, joint pain, cramps, etc.)	1	0,002	
	<i>Syzygium aromaticum.</i>	Qarounfel	Seeds	Infusion	Dry	Pain and inflammation (headaches, joint pain, cramps, etc.)	15	0,037	
Nitrariaceae	<i>Peganum harmala</i>	Al-Harmal	Seeds	Maceration	Dry	respiratory problems (cough, cold, bronchitis, etc.)	1	0,002	0,002
Oleaceae	<i>Jasminum officinale</i>	Yasmine	Others	Others	Dry	Skin problems (acne, irritations, burns...)	1	0,002	0,021
	<i>Olea europaea</i>	Zitoune	Leaves	Infusion	Dry	Digestive problems (bloating, stomach aches, constipation...)	15	0,037	
Papaveraceae	<i>Papaver rhoeas</i>	Blà'man	Seeds	Maceration	Dry	Pain and inflammation (headaches, joint pain, cramps, etc.)	30	0,074	0,074
Pedaliaceae	<i>Sesamum indicum</i>	Janjlan	Seeds	Maceration	Dry	Digestive problems (bloating, stomach aches, constipation...)	1	0,002	0,002
Piperaceae	<i>Piper cubeba</i>	Kabāba	Seeds	Decoction	Dry	Pain and inflammation (headaches, joint pain, cramps, etc.)	1	0,002	0,002

Plantaginaceae	<i>Plantago</i> spp.	Messassa	Leaves	Infusion	Dry	Pain and inflammation (headaches, joint pain, cramps, etc.)	1	0,002	0,002
Poaceae	<i>Cymbopogon schoenanthus</i>	Dabah	Leaves	Maceration	Dry	Pain and inflammation (headaches, joint pain, cramps, etc.)	1	0,002	0,004
	<i>Pennisetum glaucum</i>	Illane	Seeds	Infusion	Dry	Pain and inflammation (headaches, joint pain, cramps, etc.)	2	0,005	
Polygonaceae	<i>Rumex vesicarius</i>	Humaida	Leaves	Maceration	Dry	Digestive problems (bloating, stomach aches, constipation...)	3	0,007	0,007
Portulacaceae	<i>Portulaca oleracea</i>	Rejla	Leaves	Maceration	Costs	Digestive problems (bloating, stomach aches, constipation...)	1	0,002	0,002
Ranunculaceae	<i>Nigella sativa</i>	Sanoj	Seeds	Maceration	Dry	Pain and inflammation (headaches, joint pain, cramps, etc.)	12	0,030	0,016
	<i>Delphinium staphisagria</i>	Habbat el rass	Seeds	Compress	Dry	Others	1	0,002	
Rhamnaceae	<i>Ziziphus spina-christi</i>	Nbq	Seeds	Decoction	Dry	Digestive problems (bloating, stomach aches, constipation...)	18	0,044	0,044
Rosaceae	<i>Crataegus monogyna</i>	Zarour	Seeds	Maceration	Dry	Pain and inflammation (headaches, joint pain, cramps, etc.)	5	0,012	0,009
	<i>Rosa damascene</i>	Al-Ward Al-Baladi)	Others	Infusion	Dry	Fatigue and immune system support	2	0,005	
Rubiaceae	<i>Rubia tinctorum</i>	Foa	Roots	Maceration	Dry	Pain and inflammation (headaches, joint pain, cramps, etc.)	11	0,027	0,027
Rutaceae	<i>Citrus sinensis</i>	Bortoqal	Leaves	Infusion	Costs	Respiratory problems (cough, cold, bronchitis, etc.)	1	0,002	0,004
	<i>Citrus limon</i>	Limoune	Leaves	Maceration	Dry	Fatigue and immune system support	2	0,005	
Smilacaceae	<i>Smilax aspera</i>	Sabrina	Roots	Maceration	Dry	Pain and inflammation (headaches, joint pain, cramps, etc.)	1	0,002	0,002
Sapindaceae	<i>Sapindus mukorossi</i>	Sabounia	Leaves	Maceration	Costs	Others	1	0,002	0,002
Solanaceae	<i>Mandragora officinarum</i>	Bid el goul	Roots	Maceration	Dry	Skin problems (acne, irritations, burns...)	1	0,002	0,002

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Theaceae	<i>Camellia sinensis</i>	Shay alakhdar	Leaves	Maceration	Dry	Stress and sleep disorders (anxiety, insomnia...)	9	0,022	0,022
Thymelaeaceae	<i>Daphne gnidium</i>	Al-lazzaz	Leaves	Maceration	Dry	Others	2	0,005	0,005
Urticaceae	<i>Urtica dioica</i>	Horiga el melssa	Leaves	Compress	Costs	Pain and inflammation (headaches, joint pain, cramps, etc.)	13	0,032	0,032
Verbénaceae	<i>Verbena officinalis</i>	Louiza	Leaves	Infusion	Costs	Fatigue and immune system support	48	0,118	0,118
Zingiberaceae	<i>Curcuma longa</i>	Khrkoum	Others	Maceration	Dry	Pain and inflammation (headaches, joint pain, cramps, etc.)	1	0,002	0,007
	<i>Zingiber officinale</i>	Zanjabile	Stem	Infusion	Dry	Pain and inflammation (headaches, joint pain, cramps, etc.)	5	0,012	

Table 3. Number of taxa (Nt), Number of use-reports (Nur) Informant Agreement Ratio (IAR).

Maladie	Liste des espèces végétales utilisées et nombre d'utilisations	Nt	Nur	IAR
Digestive disorders	<i>Ajuga iva</i> (1), <i>Allium cepa</i> (5), <i>Apium graveolens</i> (5), <i>Armoise commune</i> (10), <i>Camomille allemande</i> (1), <i>Capparis spinosa</i> L.(1), <i>Carduus pycnocephalus</i> (5), <i>Ceratonia siliqua</i> (1), <i>Coriandrum sativum</i> (8), <i>Cuminum cyminum</i> (3), <i>Cupressus sempervirens</i> L.(1), <i>Dittrichia viscosa</i> (100), <i>Eruca sativa</i> (1), <i>Ficus carica</i> L.(1), <i>Foeniculum vulgare</i> (6), <i>Glycyrrhiza glabra</i> (1), <i>Hyphaene thebaica</i> (18), <i>Ilex paraguariensis</i> (2), <i>Juniperus</i> spp.(6), <i>Laurus nobilis</i> (16), <i>Lavandula multifida</i> (226), <i>Leontice leontopetalum</i> (1), <i>Linum usitatissimum</i> L.(3), <i>Lupinus albus</i> L.(1), <i>Marrubium vulgare</i> (34), <i>Mentha pulegium</i> (19), <i>Mentha spicata</i> (29), <i>Nasturtium officinale</i> W.T. Aiton (1), <i>Olea europaea</i> (14), <i>Olea europaea</i> L.(15), <i>Opuntia ficus-indica</i> (1), <i>Origanum majorana</i> (14), <i>Pimpinella anisum</i> (12), <i>Pistacia atlantica</i> (35), <i>Portulaca oleracea</i> L.(1), <i>Raphanus raphanistrum</i> (1), <i>Raphanus sativus</i> (12), <i>Rumex vesicarius</i> (3), <i>Sesamum indicum</i> L.(1), <i>Thymus vulgaris</i> (34), <i>Trachyspermum ammi</i> (12), <i>Trigonella foenum-graecum</i> (11), <i>Ziziphus spina-christi</i> (18)	43	690	0,94
Inflammatory conditions	<i>Acalypha indica</i> L.(11), <i>Ajuga iva</i> (230), <i>Allium sativum</i> (6), <i>Aloe vera</i> (1), <i>Anacyclus pyrethrum</i> (4), <i>Anastatica hierochuntica</i> (4), <i>Armoise commune</i> (25), <i>Armoracia rusticana</i> (5), <i>Artemisia herba-alba</i> (2), <i>Borago officinalis</i> (1), <i>Calendula officinalis</i> L.(1), <i>Carum carvi</i> (12), <i>Chamaerops humilis</i> (1), <i>Chenopodium album</i> (1), <i>Chenopodium ambrosioides</i> L.(1), <i>Citrullus colocynthis</i> (L.) Schrad.(1), <i>Crataegus monogyna</i> (5), <i>Curcuma longa</i> (1), <i>Cuscuta campestris</i> (1), <i>Cymbopogon schoenanthus</i> (1), <i>Cynara scolymus</i> L.(2), <i>Euphorbia resinifera</i> (4), <i>Ferula communis</i> (6), <i>Genista clavate</i> (5), <i>Haloxylon scoparium</i> (1), <i>Herniaria hirsuta</i> L.(7), <i>Laurus nobilis</i> (1), <i>Lepidium sativum</i> (1), <i>Marrubium vulgare</i> (1), <i>Melissa officinalis</i> L.(18), <i>Muscari</i> spp (2), <i>Myrtus communis</i> (1), <i>Nerium oleander</i> (5), <i>Nigella sativa</i> (12), <i>Ocimum basilicum</i> (7), <i>Olea europaea</i> (1), <i>Origanum vulgare</i> (25), <i>Papaver rhoeas</i> L.(30), <i>Pelargonium graveolens</i> (1), <i>Pennisetum glaucum</i> (2), <i>Petroselinum crispum</i> (11), <i>Piper cubeba</i> (1), <i>Pistacia lentiscus</i> (1), <i>Plantago</i> spp.(1), <i>Rhaponticum acaule</i> (2), <i>Rhaponticum acaule</i> (L.) DC(3), <i>Rubia tinctorum</i> L.(11), <i>Salvia officinalis</i> (51), <i>Salvia Rosmarinus</i> (54), <i>Saussurea costus</i> (1), <i>Scolymus hispanicus</i> L.(3), <i>Smilax aspera</i> L.(1), <i>Sorghum bicolor</i> (1), <i>Syzygium aromaticum</i> (15), <i>Teucrium polium</i> L.(1), <i>Thapsia garganica</i> L.(2), <i>Thymus vulgaris</i> (77), <i>Urtica dioica</i> (13), <i>Zingiber officinale</i> (5)	59	701	0,92
Immune system disorders	<i>Artemisia absinthium</i> (19), <i>Camomille allemande</i> (28), <i>Citrus limon</i> (2), <i>Lavandula angustifolia</i> (39), <i>Rosa damascene</i> (2), <i>Verbena officinalis</i> (48)	6	138	0,96
Stress and sleep disorders	<i>Camellia sinensis</i> (9), <i>Camomille allemande</i> (23), <i>Cinnamomum verum</i> (8), <i>Crocus sativus</i> (6), <i>Mentha spicata</i> (16)	5	62	0,93
Respiratory disorders	<i>Ammi visnaga</i> (L.) Lam.(15), <i>Citrus sinensis</i> (1), <i>Dysphania ambrosioides</i> (14), <i>Eucalyptus globulus</i> (3), <i>Mentha pulegium</i>	10	47	0,80

	(4), <i>Mentha suaveolens</i> Ehrh.(2), <i>Mobula birostris</i> (1), <i>Pastinaca sativa</i> (1), <i>Peganum harmala</i> (1), <i>Salvia rosmarinus</i> (5)			
Skin disorders	<i>Herniaria hirsuta</i> L.(1), <i>Hibiscus fragilis</i> (2), <i>Jasminum officinale</i> L.(1), <i>Mandragora officinarum</i> L.(1), <i>Myristica fragrans</i> Houtt (1), <i>Myristica fragrans</i> Houtt (5), <i>Teucrium polium</i> (2)	7	13	0,50
Other	<i>Carlina acaulis</i> (11), <i>Cyperus esculentus</i> L.(1), <i>Daphne gnidium</i> L.(2), <i>Delphinium staphisagria</i> L.(1), <i>Foeniculum vulgare</i> (4), <i>Lawsonia inermis</i> (2), <i>Malva sylvestris</i> L.(3), <i>Ocimum basilicum</i> (7), <i>Pelargonium graveolens</i> (4), <i>Ricinus communis</i> L.(15), <i>Sapindus mukorossi</i> (1)	11	51	0,80

## Discussion

Our study has documented a wealth of traditional knowledge about medicinal plants in the Fez-Meknes region, confirming that local individuals continue to use herbal remedies for several reasons, including low cost, moderate side effects, and, above all, cultural confidence in their effectiveness (Jaouad *et al.* 2025). These observations also reinforce similar findings in Morocco and in the same region, where phytotherapeutic practices remain widely favored natural resources in our country (Achour *et al.* 2022).

Lamiaceae and Verbenaceae are the most common families in our study, with FUV results of a (FUV=0) and a (FUV=0.118) respectively, which is consistent with numerous national surveys (Ajjoun *et al.* 2021). The latest studies in the same region show that among the families used, Lamiaceae represents the highest proportion of species (12 species, more than 40% of the parts used were leaves) (Tlemcani *et al.* 2023). This occurrence could be due to the high abundance of secondary metabolites in Lamiaceae, their adaptation to climatic conditions, and their role in medicinal traditions (Maache *et al.* 2024). The species with high UV values in our study are *Ajuga iva* (UV=0.57), *Lavandula multifida* (UV=0.56), *Thymus vulgaris* (UV=0.27), and *Dittrichia viscosa* (UV=0.25). These species should be prioritized for phytochemical and pharmacological analysis. These species are also found in other ethnobotanical studies, confirming their therapeutic importance and the traditional knowledge passed down from generation to generation (Ez Zoubi *et al.* 2022, Nicerine *et al.* 2025). Nevertheless, anthropogenic pressure and overexploitation underscore the importance of implementing sustainable conservation strategies, already recommended by (Bencheikh *et al.* 2024).

Our results also confirm those reported in the local literature, highlighting a predominance of uses related to digestive disorders, stress and sleep disorders, inflammatory conditions, and common pathologies such as respiratory disorders. These results reflect both the predominance of these health needs, especially in rural populations, and the recognized empirical efficacy of plants from the region (El Finou *et al.* 2023). On the other hand, the versatile use of certain species in cosmetic care, sometimes in everyday food, and in traditional medicine illustrates the multifunctionality of the local flora and the fluidity of the boundaries between prevention, nutrition, and traditional therapy (Diniz *et al.* 2020, Maache *et al.*, 2024). As for the parts of plants used, leaves were the most frequently used in our survey, which is consistent with other studies conducted in the same region (Moumen *et al.* 2025, Salhi 2023), and elsewhere in Morocco, where their availability, ease of preparation, and richness in bioactive compounds explain this preference (Jeddi *et al.* 2024). With regard to preparation methods, maceration and infusion appear to be the most common practices, confirming their major role in the extraction of secondary metabolites and in reducing the toxic risks associated with certain species (Al-Robai *et al.* 2022).

The results of our ACM (Dim1 = 27.69%; Dim2 = 18.85%; explained variance = 46.54%) show that the use of medicinal and aromatic plants (MAPs) is structured by age, level of education, place of residence and gender: young urban graduates make little use of MAPs, while older, rural and less educated people use them moderately to heavily. Our study is consistent with several recent Moroccan surveys: studies conducted in the Khemisset region and the western High Atlas have also highlighted a higher prevalence of traditional use among rural and elderly populations, as well as a decline in practices among educated young urbanites (Radi *et al.* 2024). Similarly, research on metabolic and liver disorders conducted in Morocco has highlighted the central role of women in the preservation and transmission of ethnobotanical knowledge, which corroborates our observation of greater female involvement in the use of MAP (Bouquoui *et al.* 2025). Finally, recent surveys in the Fez-Meknes region confirm the high diversity of species and the division of use according to socio-demographic profiles, which reinforces the external validity of our results and highlights the need to guide promotion and conservation

strategies (raising awareness among young urban dwellers, supporting rural knowledge holders) in the Moroccan context (Benamar *et al.* 2025).

The results obtained highlight the continuation of common ethnobotanical knowledge passed down from one generation to the next, while emphasizing the importance of further pharmacological and phytochemical studies on the most widely used species. They also emphasize the need to develop sustainable management and conservation strategies with the aim of preserving and promoting local plant biodiversity, recognized as a therapeutic heritage.

## Conclusion

The ethnobotanical study conduit in the Fez-Meknes region revealed significant use of medicinal and aromatic plants (MAPs) among the local population, highlighting their central role in traditional therapeutic practices. Among the participants, [63.2%] of women and [36.8%] of men reported regularly using MAPs to prepare traditional remedies.

A total of 123 plant species belonging to 55 botanical families were identified as being used in this context. Demographic analysis revealed distinct trends according to user profile: the majority were women under the age of 50, with a primary education or illiterate, living in rural areas.

The most frequently cited species included *Ajuga iva* (UV = 0.57), *Lavandula multifida* (UV = 0.56), *Thymus vulgaris* (UV = 0.27), and *Dittrichia viscosa* (UV = 0.25). Among the dominant botanical families, Lamiaceae (FUV = 0.154), Verbenaceae (FUV = 0.118), and Papaveraceae (FUV = 0.073) were the most represented.

Regarding the parts of plants used, leaves accounted for the majority (PPV = 78%), while the most common preparation methods were maceration (63.87%) and infusion (23.26%).

These results highlight the diversity and richness of MPA used in the region, while emphasizing the varied profiles of users and the specific practices associated with them. They provide a solid basis for future studies aimed at exploring the bioactive properties of the species identified and developing natural therapeutic applications.

## Declarations

**List of abbreviations:** FUV - Family Use Value; UV - Use Value; PPV - Plant Part Value; IAR - Informant Agreement Ratio; SPSS - Statistical Package for the Social Sciences; UV - Use value; Ns- Number of species; UR- Use Reports; N - Number of informants; RU- Reported Uses; MCA - Multiple Component Analysis

**Ethics approval and consent to participate:** All participants were informed of the study's objectives and procedures, and verbal informed consent was obtained prior to each interview. Participation was entirely voluntary, and data were collected anonymously and in accordance with the ethical principles of ethnobotanical research.

**Consent for publication:** Not applicable

**Availability of data and materials:** Not applicable

**Competing interests:** Not applicable

**Funding:** This work was supported by the National Center for Scientific and Technical Research (CNRST) through the PhD-Associate Scholarship-(PASS) Program.

**Author contributions:** M.D. Conducting field surveys, writing the manuscript, analyzing and interpreting data, corresponding author, and submission. M.E. Review of the botanical aspects of plants. A.A. Design and development of the work, critical review of the content, final approval. C.T et I.A.E. Data analysis and interpretation. Y.E. Contribution to the writing. N.K. Revision of the English version of the manuscript. A.L et D.H. Supervision, scientific guidance, and final validation of the manuscript.

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