Trop J Nat Prod Res, October 2025; 9(10): 4844 - 4860 ISSN 2616-0684 (Print)
ISSN 2616-0692 (Electronic)

Tropical Journal of Natural Product Research

Available online at https://www.tjnpr.org

Original Research Article

Ethnobotanical Study of Medicinal Plants used for Therapeutic Purposes by the Population of the Sidi Kacem region in Northeastern Morocco

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ARTICLE INFO

Article history:
Received 29 August 2025
Revised 19 September 2025
Accepted 25 September 2025
Published online 01 November 2025

ABSTRACT

In the Sidi Kacem region of Morocco, an ethnobotanical study was carried out with the goal of conserving traditional oral knowledge on the use of therapeutic plants. This study is a continuation of our earlier work and is a component of larger ethnobotanical research, with the goal of enhancing and expanding upon the ethnobotanical data in the study area. The study involved 530 local inhabitants in all. Open-ended, semi-structured interview questions served as the foundation for the methodology. Basic statistical tools and quantitative indices like plant part value, fidelity level, informant agreement rate, botanical family use value, and species use value were used to examine the data. 75 plant species, spread throughout 41 botanical families, were identified during the study. With 12 species, the Lamiaceae family had the highest representation (0.21). The one with the highest usage value (0.69) was *Dittrichia viscosa* (L) Greuter. 34 plant species were identified with a maximum Fidelity Level of 100%. The highest level of informant consensus was found for uses pertaining to viral infections, digestive, metabolic, and nervous system illnesses (0.97). The fidelity level reached 100%, indicating strong consistency in plant use. Leaves were the most frequently employed plant part (0.489), whereas powders represented the most common form of preparation. These findings highlight both the floristic richness of the region and the robustness of traditional knowledge associated with medicinal plants. They further underscore the need for comprehensive phytochemical and pharmacological investigations of local species.

Keywords: Sidi Kacem, Ethnobotanical study, Therapeutic uses, Medicinal plants

Introduction

Medicinal plants have been used as therapeutic resources since ancient times to treat illnesses and preserve human health. The availability of many synthetic medications and the impressive advancements in modern pharmacology have not stopped the growing interest in plant-based remedies. Herbal medicines are frequently preferred over traditional pharmaceuticals in rural areas due to their accessibility, affordability, general effectiveness, and lack of adverse effects. This preference is especially strong in these areas.[1,2] The historical reverence for healers, who were often physicians or priests, demonstrates the more than 20,000-year-old connection between medical knowledge and spiritual practice. [3,4] These long-lasting benefits have led many people to continue using medicinal herbs as a supplement or substitute for manufactured medications. Because of their relaxing, antibacterial, antioxidant, and soothing qualities, many plant species are used in traditional medicine to treat a variety of conditions, both dermatological and non-dermatological. Despite being common in many places, these activities are still mainly ignored in the ethnobotanical literature.

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Citation: El Khomsi M, Hmamou A, Tahiri NE, El Massoudi S, Doubi M, Hmouni D. Ethnobotanical study of medicinal plants used for therapeutic purposes by the population of the Sidi Kacem region in northeastern Morocco. Trop J Nat Prod Res. 2025; 9(10): 4844 – 4860 https://doi.org/10.26538/tjnpr/v9i10.22

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Therefore, to completely understand traditional plant knowledge and its significance in local communities, a detailed analysis of their medical uses is required.[5–7] A significant portion of the population in developing countries—estimated at 70% to 95%, according to a 2011 World Health Organization report—relies primarily on medicinal plants for basic healthcare needs.[8] Despite ongoing advances in modern medicine, traditional knowledge systems continue to play a crucial role in the development of pharmaceutical and personal care products, many of which are plant-based. With about 135 plant families, 940 genera, and 4,500 species, Morocco, a country in the Mediterranean, is renowned for its remarkable botanical richness and serves as a rich and important genetic reservoir.[9] Ethnobotanical studies on medicinal plants remain limited, particularly in certain regions of Morocco. This research builds upon our previous work conducted in the province of Sidi Kacem, which primarily focused on dermato-cosmetic applications.[10] The present study aims to build on previous research by providing more comprehensive documentation of the therapeutic uses of medicinal plants and analyzing the relationships between the identified species and their traditional uses. This approach highlights the novelty and relevance of the study, while the applied methods ensure that empirical knowledge is transformed into solid scientific evidence for sustainable use.

Materials and Methods

Study area

Sidi Kacem Province is situated in northwestern Morocco and forms part of the Rabat-Salé-Kénitra administrative region. It extends over roughly 3,113 km² and is composed of 29 local municipalities, five of which are classified as urban while the remaining twenty-four are rural.

The province shares boundaries with Kenitra to the west, Taounate to the east, Chefchaouen to the north, and Meknes to the south (Figure 1). Data from the national census of population and housing carried out in September 2014 indicate that Sidi Kacem had 270,522 inhabitants at that time, representing about 11.4% of the region's total population. The economy of the province is largely dependent on farming and animal husbandry, whereas tourism remains a relatively minor economic activity.[11] The climate of the province shows strong variation depending on the relief. In the plains, conditions are generally semi-arid, with limited rainfall and an average annual temperature close to 18 °C. During winter, particularly in January, minimum temperatures drop to between 4 and 7 °C, whereas in midsummer (July–August) they often climb to 36–40 °C. The dry season typically lasts from early June until the end of September. In contrast, the mountainous zones experience a different pattern: winters are marked by significant precipitation, averaging 500–600 mm, while summers tend to be hot and dry, with temperatures fluctuating between 29 and 40 °C.[12]

In Sidi Kacem Province, two main soil types can be distinguished. The most widespread is the Tires soil, which covers nearly 92% of the territory and is known for being difficult to cultivate and exploit. The second type, much less extensive (around 8%), is the Dehs soil, recognized for its high natural fertility and good drainage capacity.[13]

Figure 1: Mapping representation of study area of Sidi Kacem

Survey method

An ethnobotanical survey was carried out over a one-year period, from February 1, 2024, to February 1, 2025, with the aim of documenting the traditional therapeutic use of medicinal plants. The study employed a comprehensive qualitative approach, combining several research techniques to ensure a rich and reliable dataset. Initially, free-listing exercises were conducted to identify the plant species most frequently mentioned by local informants. This was followed by semi-structured questionnaires designed to collect detailed information on preparation methods, types of treatment, application duration, formulations, and any observed side effects associated with the therapeutic use of these plants. In order to gather a wider range of local knowledge and enable information triangulation, focus groups and direct interviews were also held. A total of six focus group meetings were conducted, with six to ten participants chosen from among important members of the community, such as herbalists, traditional healers, elderly ladies, and other people with established experience. The individual interviews were enhanced by these group conversations, which also made it possible to confirm recurring trends in the usage of plants for medicinal purposes. According to Martin (2014), the methodology followed accepted ethnobotanical criteria.[14]

The questionnaire was divided into two primary sections in order to preserve scientific rigor in both data collection and analysis. Along with generic information about the plants, like local names, usage areas, and market availability, the first phase gathered demographic data from the participants. The second section focused exclusively on the therapeutic applications of the plants, covering preparation techniques, treatment types, duration, formulation, and possible side effects (Annex 1). Participants were chosen at random from the research population, including men and women aged 15 years and older. In total, 530 individuals participated in the survey, comprising 215 men and 315 women. In accordance with suggested procedures, a stratified random sampling technique was used to guarantee that the sample was representative of the total research population.[15]

Identification and preservation of plant species

The informants' stated plant species were gathered straight from their native environments. Every specimen was meticulously sampled for taxonomic identification and photographed from various perspectives to document its morphological features. The collected samples were then prepared and incorporated into a reference herbarium, ensuring long-term preservation for future research. The Biodiversity and Resources Laboratory, Department of Biology, Faculty of Science, Ibn Tofail University, Kenitra, Morocco, is where taxonomic analyses were carried out. Determination keys and reputable reference materials, such as the Practical Flora of Morocco, were essential to botanical identification.[16] The World Flora Online database (2024) and Morocco's Medicinal Plants.[17] and the World Flora Online database (2024), to guarantee accurate and rigorous classification. These resources were used to ensure precise species identification based on distinctive morphological traits and established scientific standards in plant taxonomy.

Participants' consent and ethical considerations

The Ethics Committee of Ibn Tofail University's Biology Department gave its ethical approval for this project. Oral informed consent was acquired at the beginning of data collection, initially from the community and then from each participant before their individual interview. Participants received explicit notice that the study had no commercial goals and was being carried out only for academic purposes. Their participation was completely optional, and they could request that their data be removed at any time. Furthermore, participants explicitly consented to the use of certain personal information in the context of this publication.

Statistical analysis

Descriptive and quantitative statistical approaches were used to assess the informants' sociodemographic data. Parameters such as age, gender, and educational level were investigated by one-way analysis of variance (one-way ANOVA) and independent-sample t-tests. These statistical procedures were employed to evaluate significant differences among the study groups. A significance threshold of $p < 0.05$ was set, indicating that observed differences are unlikely to have occurred by chance and may have scientific relevance. The Statistical Package for the Social Sciences (SPSS) version 20 and Microsoft Excel 2013 were used for all analyses, guaranteeing that the data were methodically arranged, processed, and interpreted in accordance with established protocols.

Family Use Value (FUV)

To assess the importance of medicinal plants in the community under study, data from the ethnobotanical survey was examined using a number of quantitative indices. A commonly used quantitative metric for estimating the relative importance of plant species as perceived by local communities is the Species Use Value (SUV).[7] This value was calculated using the following equation 1: $\text{SUV} = \frac{\sum UR}{N}$

The term "Usage Report" (UR) describes how frequently an informant cites a specific plant species for a given purpose. That is, a single source can mention several uses for the same species

For that particular plant species, N is the total number of informants interviewed.

Species Use Values (SUV)

Using the Family Use Value (FUV) index, the importance of several plant families was assessed. In ethnobotanical research, this indicator is frequently used to gauge the cultural significance of plant groups. It calculates a botanical family's proportional worth by looking at the usage that local populations have described. By dividing the total number of species in a family by the sum of their use values, the FUV is determined. Researchers can ascertain the typical degree of use and significance of plants within a certain family using this method.[18] The calculation of this index was performed using the following equation 2:

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

UVs are the total of the use values for every species in a certain botanical family. To put it another way, it shows how many use citations informants reported for each species in that family.

N_S stands for the total number of species in that particular family.

Plant Part Value (PPV)

The relative importance of each plant part used for medicinal purposes by the local population was assessed using the Plant Part Value (PPV).[19] The participant's most common citation and usage of the plant part with the highest PPV suggests that it plays a significant role in traditional practice. The equation 3 below is used to determine the PPV:

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

The term "Reports of Use" (RU) describes the total number of documented uses for a specific plant, taking into account all of its parts, including leaves, roots, stems, flowers, and others.

RU plant part represents the cumulative number of specific uses reported for a particular part of the plant (for example, only the leaves or only the roots).

Informant Agreement Ratio (IAR)

In ethnobotany and ethnopharmacology, the Informant Agreement Ratio (IAR) is a frequently used quantitative metric, designed to assess the degree of consensus among participants regarding the reported uses of plants within a particular category. This indicator provides insight into the reliability and consistency of local knowledge by highlighting areas of strong agreement among informants.[5] The equation 4 below is used to determine the IAR:

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

Nur (Number of Reported Uses): The number of times a plant use has been mentioned in a certain category is represented by this characteristic. In other words, it reflects how frequently informants mentioned the use of plants for that particular purpose.

Nt, or Number of Taxa, is the total number of different plant species used in a certain category.

Fidelity Level (FL)

A statistical metric called the Fidelity Level (FL) is used to determine which plant species are most commonly used by a community to cure a specific condition. This index provides an indication of the degree of preference or confidence that informants place in a specific plant for a given therapeutic application.[5] The equation 5 below is used to determine the Fidelity Level:

$$\text{FL} = \frac{UR}{URt} \times 100$$

The Usage Report for a Specific Disease (UR) metric indicates how frequently informants mention a specific plant species as a remedy for a given ailment.

The Total Number of Mentions of the Species (URt) This is the total number of times the plant species is brought up in relation to all diseases that have been recorded, regardless of the type of treatment.

Results and Discussion

Use of Medicinal Plants According to Gender

The results show that both men and women in the research region make extensive use of plants for medicinal purposes and practice traditional medicine. In addition to their numerical domination in the survey, women's higher percentage of the sample (59.4%) than men's (40.6%) underscores their centrality in health and wellness activities. With a statistically significant gender difference in the use of medicinal plants ($\chi^2 = 23.62$; $p < 0.001$) validated by a chi-square test, women are more likely to engage in these practices (Table 1).

Table 1: Demographic data of respondents

Variables	Categories	Total	Percentages (%)	X2	p-Values
Gender	Female	315	59.4%	23.62	p <0,001
	Male	215	40.6 %		
	<15 years	10	1.9%		
Age	15-35	135	25.5%	114.46	p <0,001
	35-55	143	27%		
	>55 years	242	45.7%		
	Illiterate	160	30.2%		
Education level	Primary	123	23.2%		
	College	111	20.9%	129.19	p <0,001
	Secondary	84	15.8%		
	University	52	9.8%		

Deeply ingrained sociocultural traditions are largely responsible for women's important participation in the knowledge and application of medicinal herbs. Like in many rural parts of northern and north-central Morocco, women play a crucial role in maintaining family health in the Sidi Kacem region. They are primarily responsible for preparing traditional remedies, administering them within the household, and overseeing daily well-being. Through this constant involvement, they acquire extensive expertise in medicinal plants and develop diverse practices that are often passed down across generations. Their contribution, therefore, goes beyond the domestic sphere and represents a cornerstone of community-based traditional medicine.[5,19–22] In nations like Ethiopia, and Brazil, where women are primarily responsible for the transfer and mastering of ethnobotanical knowledge pertaining to family health, similar trends have been seen. This predominance is closely linked to their responsibilities in childcare, food preparation, and the overall management of household life.[23–25] However, in other parts of northern Thailand and India, where men are more prevalent in the use of herbal medicine, different trends have been noted. This male

predominance is often linked to their social status as traditional healers, as well as to the fact that the collection of medicinal plants frequently requires journeys into forests—tasks historically and culturally designated as male responsibilities. Such practices shape a gendered distribution of ethnobotanical knowledge that differs markedly from patterns observed in other regions.[26,27] The gendered division of work, disparities in access to natural resources, and cultural norms can all be used to explain these disparities. While the ethnobotanical patterns seen in North Africa and some parts of Sub-Saharan Africa align with our findings, the cross-cultural diversity highlights the significance of understanding gender-related differences in their respective ecological and social settings. Rather than assuming universality, these distinctions reflect the intricate interplay between cultural practices, social structures, and environmental conditions, emphasizing the necessity of including these elements into ethnobotanical studies in order to obtain a more thorough grasp of how traditional knowledge and practices are distributed.[27,28]

Use of Medicinal Plants According to Age

Age and herbal remedy knowledge were clearly correlated, according to an analysis of plant use by age in the province of Sidi Kacem. Compared to younger participants, older people showed a deeper comprehension of the medicinal qualities of plants. In particular, 36% of those with significant experience were older than 55, and 27% were between the ages of 35 and 55. 25.5% of informed participants were young adults (14–35 years old), with the lowest percentage (1.9%) being under 15 (Table 1). Traditional knowledge differed significantly between age groups, according to statistical analysis ($\chi^2 = 114.46$; $p < 0.001$).

The decline in ethnobotanical knowledge concerning the traditional use of medicinal plants across generations can be attributed to a combination of socio-cultural factors and shifts in contemporary medical practices. Younger generations increasingly distance themselves from these ancestral practices, placing greater trust in modern medicine, which is widely regarded as more effective and scientifically validated. This trend is further reinforced by rapid urbanization, improved access to conventional healthcare, and changing lifestyles, all of which contribute to a waning interest in herbal remedies and a weakening of intergenerational knowledge transmission.[22,29,30]

Use of Medicinal Plants According to Educational Level

The educational background of participants also influenced the level of ethnobotanical knowledge. Illiterate individuals constituted the largest group (30.2%), followed by those who had completed elementary school (23.2%), college (20.9%), and secondary school (15.8%). University-educated participants represented the smallest segment (9.8%) and tended to use medicinal plants less frequently (Table 1). Statistical testing revealed a significant association between education level and the depth of indigenous knowledge, with $\chi^2 = 129.19$ ($p < 0.001$), indicating that lower educational attainment was generally linked to greater familiarity with traditional plant-based remedies.

People with little formal education are mostly responsible for the transmission and preservation of traditional knowledge about the use of medicinal herbs. Through firsthand experience, close observation, and generational transmission, they have developed a deep grasp of the medicinal qualities of plants thanks to their dependence on oral traditions and ancestral customs. This emphasizes how crucial empirical knowledge is to preserving ethnobotanical practices, which are frequently disregarded in societies where formal education and the pervasive use of modern medicine predominate.[5,30,31]

Botanical Families and Species Used

An ethnobotanical survey conducted in the Sidi Kacem region documented 75 medicinal plant species traditionally used by local inhabitants for therapeutic purposes, distributed across 41 botanical families. This floristic diversity highlights the community's strong reliance on plants to prevent and treat a wide range of health conditions. Table 2 provides a detailed overview of these plants, including their vernacular and scientific names, botanical families, frequently harvested plant organs, and common preparation techniques. Core ethnobotanical indices, such as Use Report (UR), Species Use Value (SUV), and Family Use Value (FUV), were calculated to assess the relative importance of species and families within the community's therapeutic practices.

The continued use of these methods highlights the importance of medicinal plants in daily healthcare and is a reflection of deeply rooted traditional knowledge that has been passed down orally through the generations. Numerous factors contribute to their continued use, such as the acknowledged effectiveness of many species—which is frequently backed by pharmacological and ethnobotanical evidence—the belief that they are relatively safe and have fewer side effects than traditional treatments, and their affordability and accessibility, especially in places with limited access to biomedical services. Thus, this ethnobotanical legacy serves as a great resource for the advancement of natural medicines in the future in addition to being an essential part of the local culture. Furthermore, our results demonstrate the vital role that ethnobotanical knowledge plays in scientific research and public health initiatives, facilitating the creation of novel medicinal modalities and community-adapted health initiatives.[7,19] Similar findings have been documented in Morocco, emphasizing the customs and trends of local groups' use of medicinal plants.[22,30,31] To the detriment of traditional knowledge, the use of medicinal plants is less systematic and frequently replaced by commercial items in some Asian and South American contexts. Rapid urbanization, the proliferation of contemporary health practices, and the commercialization of natural resources are some of the reasons contributing to this trend, which changes how communities access and use these plants.[27]

Throughout Mediterranean environments, ethnobotanical traditions heavily rely on the botanical groups Lamiaceae, Asteraceae, Fabaceae, and Amaranthaceae, with Morocco serving as a prime example. Their wide range of therapeutic uses in traditional medicine, as well as their vast taxonomic diversity, are the main reasons for their predominance. Following Asteraceae (8 species; FUV = 0.18), Fabaceae (4 species; FUV = 0.04), and Amaranthaceae (3 species; FUV = 0.13), Lamiaceae was the most represented family in the current study with 12 species and a family usage value (FUV) of 0.21. This pattern aligns with findings from multiple ethnobotanical surveys conducted across various Moroccan regions, which consistently report the frequent use and recognized medicinal properties of these families. Collectively, these observations underscore the pivotal role of Lamiaceae, Asteraceae, Fabaceae, and Amaranthaceae in the composition and functionality of Morocco's medicinal plant repertoire, highlighting their enduring significance in both cultural and healthcare contexts.[19,20,22,30–32]

Analysis of the importance of Plant Species in the Region

The ethnobotanical investigation into the therapeutic use of medicinal plants revealed substantial variability in the Species Use Value (SUV), with numbers between 0.69 and 0.005. Such variation highlights the richness and heterogeneity of traditional knowledge systems and the wide spectrum of practices associated with plant-based remedies. Among the documented species, *Dittrichia viscosa* (L.) Greuter ranked highest (SUV = 0.69), followed by *Origanum compactum Benth*. (SUV = 0.51), *Rosmarinus officinalis* L. (SUV = 0.48), *Marrubium vulgare* L. (SUV = 0.47), *Olea europaea* L. (SUV = 0.28), *Allium sativum* L. (SUV = 0.26), *Lawsonia inermis* L. (SUV = 0.25), *Cynara humilis* L., *Carlina acaulis* L., *Mentha pulegium* L. (SUV = 0.24), as detailed in Table 2. The prominence of these species underscores their central role in local traditional medicine, where they are not only highly recognized but also frequently prescribed within community-based therapeutic practices.

Dittrichia viscosa (L.) Greuter occupies a key position in the traditional pharmacopoeia of the Sidi Kacem region and was the most frequently cited species in this study. It is especially valued for its therapeutic applications in treating wounds, burns, and inflammatory skin disorders. Its diverse array of bioactive substances, such as flavonoids, guaianolide triterpenoids, sesquiterpenes, sesquiterpene acids, lactones, essential oils, and caffeic acids, are responsible for these therapeutic benefits.[33–37] Its repeated use by the local population underscores the importance of this species in ethnomedicinal practices and reflects extensive traditional knowledge transmitted across generations. Similar

findings have also been reported in other regions of Morocco, confirming the central role of *Dittrichia viscosa* (L.) Greuter in Moroccan traditional medicine. [8,22,38]

Origanum compactum Benth. is widely known for its many medicinal uses. It is frequently used to treat respiratory and digestive conditions, diabetes, and metabolic diseases. Among flavonoids and other secondary metabolites, the plant's high concentration of phenolic compounds—specifically thymol, α-Thujone, eugenol, and carvacrol—is largely responsible for its efficacy. These bioactive substances have antibacterial, anti-inflammatory, and antioxidant properties, underscoring the plant's pivotal function in conventional medicine and its increasing fascination in contemporary pharmacological studies.[39–41] Numerous ethnobotanical investigations carried out in Morocco have also extensively documented this plant.[19,21,22,30]

Rosmarinus officinalis L. is extensively used in traditional medicine by local populations to treat microbiological infections, wounds and burns, nervous system diseases, and inflammatory dermatoses. Pharmacological research backing up its anti-inflammatory and antibacterial qualities, which are attributed to bioactive substances including alpha-pinene, cineole, and rosmarinic acid, supports its effectiveness.[42,43] These uses reflect the importance of traditional botanical knowledge and are consistent with findings from other studies conducted in different regions of Morocco, where this species is also widely employed by local communities for its multiple therapeutic properties.[21,38,44]

Marrubium vulgare L. has been used for many years to treat a variety of illnesses in traditional medicine, as several earlier investigations have highlighted. Inflammatory diseases, respiratory ailments like colds, coughs, and respiratory tract infections, appetite loss, and illnesses of the skin, liver, stomach, heart, and immune system are among them. The variety of this species' biological activities has drawn increasing scientific attention, notwithstanding its traditional uses. According to reports, it has analgesic, antioxidant, antibacterial, anti-inflammatory, anti-edematous, and antidiabetic properties. This plant is a useful resource for both ethnomedicine and contemporary pharmacological research because of its cardioprotective, lipid-lowering, and antispasmodic qualities, which further emphasize its medicinal potential.[45,46]

Olea europaea L. is frequently employed in the field of study because of its many therapeutic uses and crucial part in conventional medical procedures. It's specifically used to treat inflammatory dermatoses, microbial infections, metabolic illnesses, and digestive issues. Additionally, its oil, leaves, and fruits are well known for their lipid-lowering, hypoglycemic, antibacterial, anti-inflammatory, and antioxidant properties. Due to these characteristics, the olive tree is a very significant therapeutic resource, particularly for the prevention and treatment of long-term illnesses linked to metabolic imbalance, cardiovascular problems, and oxidative stress.[47–51]

Henna, or *Lawsonia inermis* L., is used extensively in the research area due to its many therapeutic benefits. Additionally, it has been used historically to treat burns, wounds, microbial infections, and inflammatory dermatoses. Beyond these uses, the bioactive substances lawsone, flavonoids, and tannins found in its leaves and extracts give it strong antibacterial, wound-healing, and antioxidant properties. Its substantial therapeutic potential is highlighted by these qualities, which also support its continued application in conventional medical procedures.[52–54]

Ail, or *Allium sativum* L., has long been used in traditional medicine to treat a wide range of illnesses, from wounds and infections to rheumatism, diabetes, and abnormalities of the digestive system including diarrhea. Its abundance of bioactive metabolites is primarily responsible for this species' medicinal efficacy. A variety of organosulfur elements, including as diallyl disulfide, diallyl trisulfide, allicin, ajoene, and vinyl-dithiins, are present in it, along with prominent phenolic compounds like quercetin. Sulfur derivatives like S-allylcysteine and trace elements like selenium also improve its pharmacological profile, offering antimicrobial, antioxidant, anti-inflammatory, cardioprotective, and antidiabetic properties that account for its long history of use in both traditional medicine and contemporary research.[55,56]

Cynara humilis L. is frequently employed in the study area. It is especially used to treat burns, wounds, microbial infections, inflammatory dermatoses, and digestive issues. Flavonoids, polyphenols, tannins, and other bioactive substances found in the leaves and other plant parts support the plant's antibacterial, anti-inflammatory, antioxidant, and wound-healing properties, underscoring its importance in traditional medicine.[57–59]

In addition to the species already described, the local Sidi Kacem community makes extensive use of a number of additional plants that have shown medicinal value in prior pharmacological investigations. These include *Anchusa italica* Retz, *Chamaerops humilis* L., and *Papaver rhoeas* L., which are known for their many therapeutic qualities, such as their ability to reduce inflammation, fight off infections, and promote wound healing. The region's extensive ethnobotanical expertise is reflected in the continued use of these plants in traditional medicine.[60–66]

Usage According to the Fidelity Level

In the present investigation, 34 plant species were identified with a maximum Fidelity Level (FL) of 100%, indicating a complete alignment between the species and its specific therapeutic application. Conversely, 41 species exhibited FL values below 100%, suggesting either a broader range of medicinal uses or less specific applications. Among those with the highest fidelity, several species were notable for their highly targeted therapeutic roles, each achieving an FL of 100%. These include *Beta vulgaris* L. and *Capparis spinosa* L. for metabolic disorders, *Musa acuminata* Colla and *Scirpus abactus* Ohwi for viral infections, *Cuminum cyminum* L. and *Ceratonia siliqua* L. for digestive disorders, *Cannabis sativa* L. and *Ruta montana* (L.) L. for inflammatory dermatoses, *Capsicum annuum* L. and *Hedera helix* L. for wounds and burns, *Asphodelus microcarpus* Salzm. & Viv. and *Curcuma longa* L. for microbial infections, *Zingiber acuminatum* Valeton for respiratory disorders and *Aloysia aloysoides* Loes. & Moldenke for nervous system disorders (Table 2).

The importance of a plant in regional medicinal practices is gauged by its fidelity level (FL). When a species receives a score of 100%, it means that it is consistently and exclusively utilized for therapeutic purposes, demonstrating widespread agreement among Sidi Kacem residents regarding its specific use. Plants with high FL values require extra care and thorough pharmacological research to demonstrate their medicinal advantages scientifically. However, species with lower FL values should not be ignored because underutilization may lead their traditional wisdom to progressively disappear.[9,27]

Usage According to the Parts of the Plants Used

Each component of the plant species under study has unique medicinal advantages. With a PPV of 0.489, the Plant Part Value (PPV) index analysis showed that leaves are the most commonly used ingredient in traditional treatments. Fruits (PPV = 0.229), roots (PPV = 0.164), and flowers (PPV = 0.046) come next, and they are equally important in medicinal preparations. However, as Figure 2 shows, other elements like rhizomes (PPV = 0.038), bulbs (PPV = 0.026), stems (PPV = 0.005), and seeds (PPV = 0.002) are utilized far less frequently. These results demonstrate a definite preference for leaves in herbal remedies, underscoring the relative significance of each plant portion in conventional therapeutic methods.

The most commonly used plant organ in this investigation was the leaf. Both biological and practical considerations account for this prevalence. Because they are readily available and renewable, leaves can be harvested practically without endangering the plant's ability to survive. Additionally, they can be made in a variety of ways, including powders, macerations, decoctions, and infusions, which makes them ideal for conventional medical procedures.[24,67] In terms of biology, leaves are the primary locations for photosynthesis and high levels of metabolic activity, which results in the synthesis and build-up of secondary metabolites such as phenolic acids, flavonoids, polyphenols, alkaloids, tannins, and terpenes. These substances play a key part in conventional therapies because of their well-known antibacterial, anti-inflammatory, antioxidant, and wound-healing qualities. Therefore, the extensive usage of leaves in ethnobotanical systems is justified by their

chemical richness.[6,28] Many Moroccan regions have shown a preference for using leaves, underscoring their fundamental and long-standing importance in regional traditional medicine. This significance is explained by their richness of bioactive chemicals and ease of accessibility, highlighting the vital role that this plant organ plays in conventional therapeutic methods.[6,9,20,68–70]

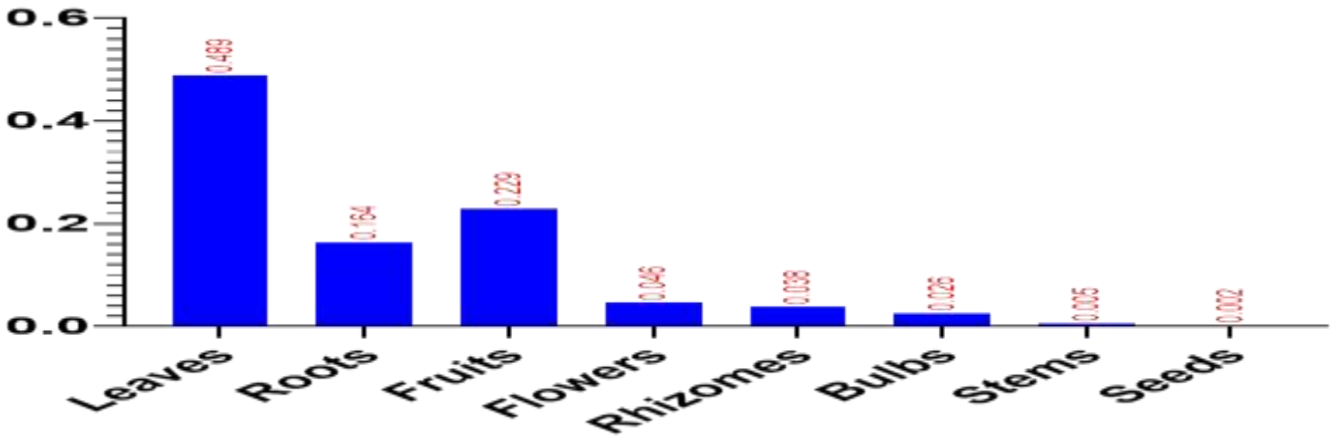

Figure 2: The different plant parts used in the ethnobotanical study

Traditional Methods of Preparation

A statistical analysis of the preparation methods employed for medicinal plant-based remedies indicates a clear predominance of powdered forms, which represent 44.06% of all recorded cases. This is followed by decoctions (9.31%), poultices (8.43%), infusions (7.4%), distillations (5.71%), and macerations (3.54%). The remaining techniques, which include various less commonly used methods, collectively account for 21.53% of preparations. These results highlight the diversity of traditional processing practices, while emphasizing the widespread preference for powdered forms in herbal medicine (Figure 3).

According to this study, the most popular way to prepare herbal treatments is with powder. Using this method, dried plant parts including leaves, roots, stems, or flowers are ground into a fine powder. By using powder, bioactive chemicals' contact surface is increased, potentially improving their medicinal efficacy and body absorption. Furthermore, this form makes it easier to preserve plant materials and permits a variety of uses, such as topical treatments, infusions, and blending with other compounds. Numerous ethnobotanical and ethnopharmacological investigations have extensively documented the usage of powder as a preparation method. [67,71–73]

Usage According to the Informant Agreement Ratio (IAR)

One important quantitative metric used to identify the most pertinent medicinal plant species in the study area was the Informant Agreement Ratio (IAR). This index provides insight not only into the frequency of use of specific taxa but also into the degree of consensus among local informants regarding their applications. IAR values range between 0 and 1, where higher values indicate a strong agreement among participants about the medicinal relevance of particular species, whereas lower values reflect greater divergence in perceptions and usage.

Analysis of the collected data revealed that viral infections, digestive disorders, metabolic disorders, and nervous system disorders were the health categories most consistently cited by informants, with an IAR reaching as high as 0.97. Close behind, wounds and burns, microbial infections, and respiratory system disorders were also frequently reported, each achieving an IAR of 0.96 (Table 3). These findings underscore the plants' critical role in addressing prevalent health concerns within the local population and highlight areas of strong ethnobotanical consensus, which may serve as a basis for prioritizing species for further pharmacological or phytochemical studies.

One important ethnobotanical metric for gauging community members' agreement on the use of particular plant species is the Informant Agreement Ratio (IAR). There is substantial agreement regarding the importance of these species, as evidenced by the study's IAR values of up to 0.97 for treatments addressing viral infections, digestive and metabolic problems, and nervous system conditions.[74,75] Nevertheless, this kind of agreement does not always mean that newer generations are actively learning this ancient knowledge. It mostly symbolizes a common understanding among specific demographic groups, frequently older folks, who serve as the primary keepers of this information. Previous ethnobotanical studies have shown that urbanization, formal education, changing lifestyles, and a decreased dependence on traditional treatments have all contributed to a drop in the generational transfer of plant knowledge.[27,76,77] Therefore, identifying plants with high IAR values emphasizes the critical need to preserve local ethnobotanical knowledge while also offering a useful route for future pharmaceutical study.

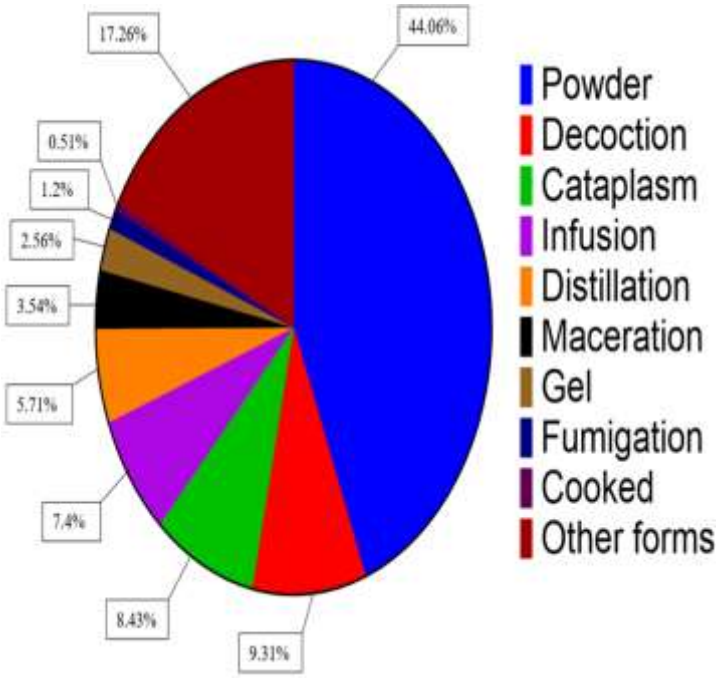

Figure 3: Percentage of different methods of preparation

ISSN 2616-0684 (Print)
ISSN 2616-0692 (Electronic)

Table 2: Medicinal plants used for therapeutic purposes

Family and botanical name	Common name	Plant parts	Preparation methods	Therapeutic uses	FL (%)	UR	SUV	FUV
Agavaceae								0.07
Agave sisalana Perrine	Sabra	Leaves	Gel	Inflammatory dermatosis, Wounds and burns, Microbial infections	59	39	0.07	
Aloeaceae								0.12
Aloe vera (L.) Burn.f.	Aloe vera	Leaves	Gel	Inflammatory dermatosis, Wounds and burns	80	62	0.12	
Amaryllidaceae								0.13
Allium cepa L.	Lbassla	Bulb	Other forms	Inflammatory dermatosis, Microbial infections, Nervous system disorders	60	45	0.08	
Allium Sativum L.	Touma	Bulb	Maceration	Microbial infections, virus infection, Digestive disorders	57	139	0.26	
Asphodelus microcarpus Salzm. & Viv	Barwag	Rhizome	Other forms	Microbial infections	100	39	0.05	
Amaranthaceae								0.17
Beta vulgaris L.	Barba	Fruits	Infusion	Metabolic disorders	100	72	0.14	
Apiaceae								0.10
Ammi visnaga (L.) Lam.	Bechnikha	Fruits	Powder	Microbial infections, Wounds and burns	83	36	0.07	
Cuminum cyminum L.	L'kamoun	Fruits	Powder	Digestive disorders	100	70	0.13	
Araliaceae								0.11
Chamaerops humilis L.	Doume	Roots	Powder	Microbial infections, Wounds and burns, Digestive disorders, Metabolic disorders	61	94	0.18	
Hedera helix L.	Louaya	Leaves	Powder	Wounds and burns	100	26	0.05	
Arstolochiaceae								0.19
Aristolochia longa L.	Barezteme	Roots	Powder	Wounds and burns, Inflammatory dermatosis, Metabolic disorders	66	103	0.19	
Asparagaceae								0.01
Drimia maritima (L.) Stearn	Onssale	Bulb	Gel	Inflammatory dermatosis	100	7	0.01	

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Asteraceae								0.18
Artemisia absinthium L.	Chiba	Leaves	Cataplasm	Microbial infections	100	12	0.02	
Artemisia herba-alba Asso.	Chih	Leaves	Decoction	Microbial infection, Virus infection, Metabolic disorders	86	43	0.08	
Calendula officinalis L.	Jamra	Leaves	Powder	Wounds and burns, Metabolic disorders	78	28	0.05	
Carlina acaulis L.	Dad	Roots	Powder	Inflammatory dermatosis, Wounds and burns, Metabolic disorders	55	129	0.24	
Cynara cardunculus L.	Kharchef	Roots	Powder	Wounds and burns, Microbial infections, Digestive disorders	46	39	0.07	
Cynara humilis L.	Tayma	Roots Leaves	Powder Infusion	Inflammatory dermatosis, Microbial infections, Wounds and burns, Digestive disorders	46	127	0.24	
Dittrichia viscosa (L) Greuter	Bagramane	Roots	Powder	Wounds and burns, Microbial infections, Inflammatory dermatosis, Metabolic disorders	53	366	0.69	
Matricaria chamomilla L.	Babounj	Flowers Fruits	Infusion	Inflammatory dermatosis, Digestive disorders, Nervous system disorders	48	33	0.06	
Boraginaceae								0.06
Anchusa italica Retz	Ouachem	Roots	Powder	Wounds and burns, Inflammatory dermatosis, Microbial infections	37	65	0.12	
Cynoglossum clandestinum Desf.	Lwacham	Roots Leaves	Powder	Wounds and burns, microbial infections, Inflammatory dermatosis	96	24	0.04	
Cynoglossum officinale L.	Lossiq	Roots	Powder	Wounds and burns, Microbial infections	67	18	0.03	
Cactaceae								0.04
Opuntia ficus indica (L.) Mill.	L'handiya	Leaves Flowers	Cataplasm Powder	Inflammatory dermatosis, Digestive disorders, Metabolic disorders	43	21	0.04	
Cannabaceae								0.02
Cannabis sativa L.	Zariat lkif	Fruits	Powder, Distillation	Inflammatory dermatosis	100	10	0.02	

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Capparaceae								0.07
Capparis spinosa L.	L'kabbar	Fruits	Infusion	Metabolic disorders	100	35	0.07	
Cupressaceae								0.07
Tetraclinis articulata (Vahl) Mast	L-araâr	Leaves	Maceration, Other forms	Virus infections, Respiratory disorders	77	35	0.07	
Cyperaceae								0.03
Scirpus abactus Ohwi	Smar	Roots	Cooked	Virus infections	100	15	0.03	
Euphorbiaceae								0.04
Mercurialis annua L.	L'horriga lmalsa	Leaves	Cataplasm Infusion	Inflammatory dermatosis, Digestive disorders	68	19	0.03	
Fabaceae								0.04
Ceratonia siliqua L.	L'kharob	Fruits	Distillation Powder	Digestive disorders	100	48	0.09	
Cicer arietinum L.	L'hamous	Stems	Cooked	Virus infections	100	28	0.05	
Trigonella adscendens (Nevski) Afan. & Gontsch.	L'halba	Fruits	Powder	Digestive disorders	100	9	0.02	
Vicia sativa L.	Gnfdo	Leaves	Cataplasm	Virus infections	100	5	0.01	
Iridaceae								0.11
Crocus sativus L.	Zaafran lhor	Flowers	Powder	Microbial infections, Wounds and burns	88	58	0.11	
Lamiaceae								0.21
Lavandula angustifolia Mill.	Khzâma	Leaves	Decoction, Powder, Distillation	Inflammatory dermatosis, Nervous system disorders, Wounds and burns, Microbial infections	45	82	0.15	
Lens culinaris Medik.	L'aâdas	Fruits	Other forms	Metabolic disorders	100	50	0.09	
Marrubium vulgare L.	Merriwa	Leaves	Cataplasm Infusion	Microbial infections, Inflammatory dermatosis, Wounds and burns, Digestive disorders	49	249	0.47	

Mentha spicata L**.**	Naânaâ	Leaves	Cataplasm, Infusion	Microbial infections, Inflammatory dermatosis, Digestive disorders, Respiratory disorders, Nervous system disorders	35	117	0.22	
Mentha suaveolens Ehrh.	Mentha	Leaves	Maceration	Microbial infections, Digestive disorders, Respiratory disorders	40	30	0.06	
Mentha pulegium L.	Fliyyo	Leaves	Other forms	Virus infections, Respiratory disorders	100	127	0.24	
Origanum compactum Benth.	Zaâtar	Leaves	Powder, Decoction, Other forms	Inflammatory dermatosis, Wounds and burns, Microbial infections, Virus infection, Digestive disorders, Respiratory disorders	25	274	0.51	
Origanum majorana L.	Berdkoch	Leaves	Decoction	Digestive disorders	100	40	0.07	
Rosmarinus officinalis L.	Azîr, Iklil ljabal	Leaves	Maceration, Cataplasm, Other forms	Inflammatory dermatosis, microbial infections, Virus infections, Digestive disorders, Respiratory disorders	36	254	0.48	
Salvia officinalis L.	Salmia	Leaves	Powder Decoction	Wounds and burns, Metabolic disorders, Nervous system disorders	48	91	0.17	
Salvia verbinaca L.	L'khiyata	Leaves	Powder	Inflammatory dermatosis, Wounds and burns	67	06	0.01	
Thymus vulgaris L.	Zaîtra	Leaves	Decoction	Digestive disorders	100	30	0.06	
Lauraceae								0.03
Cinnamomun verum J. Presl	L'karfa	Fruits	Powder	Metabolic disorders, Respiratory disorders	62	32	0.06	
Persea gratissima C.F. Gaertn.	Avocat	Leaves	Powder	Wounds and burns	100	7	0.01	
Lythraceae								0.25
Lawsonia inermis L.	L'hana	Leaves	Powder	Inflammatory dermatosis, Microbial infections, Wounds and burns	50	132	0.25	
Malvaceae								0.07
Malva neglecta Wallr.	Bakkola	Leaves	Other forms	Digestive disorders, Metabolic disorders	72	36	0.07	
Moraceae								0.04
Ficus carica L.	Tin	Fruits	Other forms	Respiratory disorders, Digestive disorders	60	20	0.04	

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Musaceae								0.14
Musa acuminata Colla	L'banane	Fruits	Other forms	Virus infections	100	74	0.14	
Myrtaceae								0.12
Eucalyptus globulus Labill.	Eucalyptus	Leaves	Other forms	Microbial infections, Virus infections, Respiratory disorders	42	102	0.19	
Syzygium aromaticum (L) Merr. & L.M.Perry	L'qronfal	Fruits	Distillation Other forms	Digestive disorders	100	28	0.05	
Oleaceae								0.28
Olea europaea L.	Zitoun	Fruits Leaves	Distillation Decoction	Inflammatory dermatosis, Microbial infections, Digestive disorders, Metabolic disorders	38	149	0.28	
Papaveraceae								0.05
Papaver rhoeas L.	Bellaâman	Leaves	Powder	Microbial infections, Wounds and burns	63	19	0.03	
Poaceae								0.06
Cynodon dactylon Pers.	Njam	Roots	Decoction	Microbial infection	100	7	0.01	
Triticum turgidum L.	Nakhala	Fruits	Powder	Inflammatory dermatosis, Digestive disorders	63	60	0.11	
Polygonaceae								0.04
Rumex acetosa L.	L'houmida	Roots	Cataplasm Other forms	Microbial infection, Digestive disorders, Metabolic disorders	43	23	0.04	
Punicaceae								0.04
Punica granatum L.	Romman	Fruits	Powder	Digestive disorders	100	24	0.04	
Ranonculaceae								0.07
Nigella sativa L.	Sanouj	Fruits Powder	Maceration	Digestive disorders, Respiratory disorders	71	35	0.07	
Rhamnaceae								0.07
Ziziphus lotus (L.) Lam.	Sadra	Fruits Leaves	Powder	Digestive disorders	100	39	0.07	
Rosaceae								0.02
Prunus amygdalus stokes var. amara DC.	Louz lhar	Fruits	Distillation	Virus infections	100	13	0.02	

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Rutaceae								0.02
Citrus limon (L.) Osbeck	L'hamed	Fruits	Other forms	Respiratory disorders	100	13	0.02	
Ruta montana (L.) L.	L'fijl	Leaves	Infusion	Inflammatory dermatoses	100	19	0.03	
Solanaceae								0.02
Capsicum annuum L.	Tahmira	Fruits	Powder	Wounds and burns	100	11	0.02	
Solanum lycopersicum L.	Maticha	Fruits	Other forms	Nervous system disorders	100	18	0.03	
Solanum Negrum L.	Aneb dib	Fruits	Powder	Inflammatory dermatoses	100	4	0.01	
Theaceae								0.04
Camellia sinensis (L.) Kuntze	Atay	Leaves	Powder	Wounds and burns, Microbial infection	62	21	0.04	
Thymeleaeceae								0.02
Daphne gnidium L.	Lazaz	Leaves	Powder	Inflammatory dermatosis	100	12	0.02	
Urticaceae								0.19
Urtica membranacea Poir. ex Savigny	Horriga	Leaves	Cataplasm Infusion	Inflammatory dermatosis, Digestive disorders	57	100	0.19	
Vitaceae								0.16
Vitis vinifera L.	Zbib	Fruits	Other forms	Virus infections	100	84	0.16	
Verbenaceae								0.09
Aloysia aloysoides Loes. & Moldenke	Lwiza	Leaves	Infusion	Nervous system disorders	100	50	0.09	
Zingiberaceae								0.10
Curcuma longa L.	L'kharkom	Rhizomes	Powder	Microbial infections	100	73	0.14	
Zingiber acuminatum Valeton	Zinjabil	Rhizomes	Powder	Respiratory disorders	100	40	0.07	

Inflammatory dermatosis: (Allergy, Eczema, Psoriasis); Microbial infections: (Furuncles, Cutaneous abscesses); Digestive disorders: (Stomachache, Diarrhea); Respiratory disorders: (Colds, Asthma, Nosebleeds); Metabolic disorders: (Tumours, Cancer, Anemia, Diabetes) ; Nervous system disorders: (Calming, Soothing, Migraine)

ISSN 2616-0684 (Print)
ISSN 2616-0692 (Electronic)

Table 3: Distribution of diseases by category, with number of taxa (Nt), total mentions (Nur), and informant agreement ratio (IAR)

Categories	Liste of plant species used with number of uses	Nt	Nur	IAR
Wounds and burns	*Agave sisalana Perrine (23), Carlina acaulis* L. (22), *Lawsonia inermis* L. (30), *Aloe vera* (L.) Burn.f. (50), *Ammi visnaga* (L.) Lam. (30), *Anchusa italica* Retz (19), *Aristolochia longa* L. (16), *Asphodelus microcarpus* Salzm. & Viv (23), *Calendula officinalis* L. (22), *Camellia sinensis* (L.) Kuntze (13), *Capsicum annuum* L. (11), *Carlina acaulis* L. (22), *Chamaerops humilis* L. (17), *Crocus sativus* L. (7), *Cynara cardunculus* L. (11), *Cynara humilis* L. (35), *Cynoglossum clandestinum* Desf. (01), *Cynoglossum officinale* L. (12), *Dittrichia viscosa* (L) Greuter (193), *Dysphania ambrosioides (L) Mosyakin & Clemants* (34), *Echinops spinosissimus* Turra (06), *Hedera helix* L. (26), *Lavandula angustifolia* Mill. (37), *Lawsonia inermis* L. (30), *Marrubium vulgare* L. (28), *Origanum compactum* Benth. (68), *Papaver rhoeas* L. (7), *Persea gratissima* C.F. Gaertn. (07), *Salvia officinalis* L. (11), *Salvia verbinaca* L. (04).	30	800	0.96
Inflammatory dermatosis	*Agave sisalana* Perrine (10), *Aloe vera* (L.) Burn.f. (12), *Allium cepa* L. (10), *Anchusa italica* Retz (24), *Aristolochia longa* L. (19), *Cannabis sativa* L. (10), *Carlina acaulis* L. (71), *Cynara humilis* L. (59), *Daphne gnidium* L. (12), *Dittrichia viscosa* (L) Greuter (20), *Drimia maritima* (L.) Stearn (07), *Echinops spinosissimus* Turra (12), *Lavandula angustifolia* Mill. (16), *Lawsonia inermis* L. (66), *Marrubium vulgare* L. (122), *Matricaria chamomilla* L. (09), *Mentha spicata* L. (21), *Mercurialis annua* L. (13), *Olea europaea* L. (56), *Opuntia ficus indica* (L.) Mill. (09), *Origanum compactum* Benth. (22), *Rosmarinus officinalis* L. (27), *Ruta montana* (L.) L. (19), *Salvia verbinaca* L. (02), *Solanum Negrum* L. (04), *Triticum turgidum* L. (22), *Urtica membranacea* Poir. Ex Savigny (43).	27	717	0.96
Microbial infections	*Agave sisalana* Perrine (06), *Allium cepa* L. (27), *Allium Sativum* L. (26), *Ammi visnaga* (L.) Lam. (6), *Anchusa italica* Retz (22), *Artemisia absinthium* L. (12), *Artemisia herba-alba* Asso. (37), *Asphodelus microcarpus* Salzm. & Viv (23), *Camellia* sinensis (L.) Kuntze (08), *Chamaerops humilis* L. (11), *Crocus sativus* L. (51), *Curcuma longa* L. (73), *Cynara cardunculus* L. (10), *Cynara humilis* L. (26), *Cynodon dactylon* Pers. (07), *Cynoglossum clandestinum* Desf. (23), *Cynoglossum officinale* L. (06), *Dittrichia viscosa* (L) Greuter (113), *Dysphania ambrosioides (L) Mosyakin & Clemants* (1), *Eucalyptus globulus* Labill. (18), *Lavandula angustifolia* Mill. (18), *Lawsonia inermis* L. (36), *Marrubium vulgare* L. (59), *Mentha spicata* L. (12), *Mentha suaveolens* Ehrh. (6), *Nerium oleander* L. (18), *Olea europaea* L. (15), *Origanum compactum* Benth. (62), *Papaver rhoeas* L. (12), *Rosmarinus officinalis* L. (58), *Rumex acetosa* L. (3).	31	805	0.96
Virus infections	*Allium Sativum* L. (33), *Artemisia herba-alba* Asso. (01), *Cicer arietinum* L. (15), *Dysphania ambrosioides (L) Mosyakin & Clemants* (20), *Eucalyptus globulus* Labill. (43), *Mentha pulegium* L. (57), *Musa acuminata* Colla (74), *Origanum compactum* Benth. (41), *Prunus amygdalus* stokes var. amara DC. (13), *Rosmarinus officinalis* L. (109), *Scirpus abactus* Ohwi (15), *Tetraclinis articulata* (Vahl) Mast (8), *Vitis vinifera* L. (84), *Vicia sativa* L. (5).	14	518	0.97

ISSN 2616-0684 (Print)
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Metabolic disorders	*Aristolochia longa* L. (68), *Artemisia herba-alba* Asso. (05), *Beta vulgaris* L. (72), *Calendula officinalis* L (06), *Capparis spinosa* L. (35), *Carlina acaulis* L. (36), *Chamaerops humilis* L. (08), *Dittrichia viscosa* (L) Greuter (40), *Lens culinaris* Medik (50), *Malva neglecta* Wallr (10), *Olea europaea* L. (52), *Opuntia ficus indica* (L.) Mill (05), *Rumex acetosa* L (10), *Salvia officinalis* L (36). *Cinnamomun verum* J. Presl (12). *Matricaria chamomilla* L. (08).	16	453	0.97
Digestive disorders	*Allium Sativum* L. (80), *Ceratonia siliqua* L. (48), *Chamaerops humilis* L. (58), *Cinnamomun verum* J. Presl (12), *Cuminum cyminum* L. (70), *Cynara cardunculus* L. (18), *Cynara humilis* L. (07), *Ficus carica* L (12), *Malva neglecta* Wallr (26), *Marrubium vulgare* L. (40), *Matricaria chamomilla* L. (08), *Mentha spicata* L. (10), *Mentha suaveolens* Ehrh. (12), *Mercurialis annua* L (06), *Nigella sativa* L (25), *Olea europaea* L. (26), *Opuntia ficus indica* (L.) Mill (07), *Origanum compactum* Benth (61), *Origanum majorana* L. (40), *Punica granatum* L (24), *Rosmarinus officinalis* L. (50), *Rumex acetosa* L (10), *Syzygium aromaticum* (L) Merr. & L.M.Perry (28), *Thymus vulgaris* L (30), *Trigonella adscendens* (Nevski) Afan. & Gontsch. (09), *Triticum turgidum* L. (38), *Urtica membranacea* Poir. Ex Savigny (57), *Ziziphus lotus* (L.) Lam (39).	28	851	0.97
Respiratory disorders	*Cinnamomun verum* J. Presl (20), *Citrus limon* (L.) Osbeck (13), *Eucalyptus globulus* Labill. (41), *Ficus carica* L (08), *Mentha pulegium* L (70), *Mentha spicata* L. (41), *Mentha suaveolens* Ehrh. (12), *Nigella sativa* L (10), *Origanum compactum* Benth (20), *Rosmarinus officinalis* L. (10), *Tetraclinis articulata* (Vahl) Mast (27), *Zingiber acuminatum* Valeton (40).	12	312	0.96
Nervous system disorders	*Aloysia aloysoides* Loes. & Moldenke (50), *Allium cepa* L. (08), *Dysphania ambrosioides* (L) Mosyakin & Clemants (49), *Lavandula angustifolia* Mill. (11), *Matricaria chamomilla* L. (16), *Mentha spicata* L. (33), *Salvia officinalis* L (44). *Solanum lycopersicum* L (18).	8	229	0.97

Conclusion

The goal of this study is to document the medicinal plants used for therapeutic reasons in the northeast Moroccan region of Sidi Kacem through a thorough ethnobotanical survey. Through field research, 75 plant species from 41 botanical families were found. Because of their high frequency of citations, the Lamiaceae and Asteraceae families stood out among these. *Dittrichia viscosa* (L.) Greuter, *Origanum compactum* Benth, *Rosmarinus officinalis* L., *Marrubium vulgare* L., *Olea europaea* L., *Allium sativum* L., and *Lawsonia inermis* L. are the plants that local informants most commonly cite for their therapeutic qualities. While leaves were the plant portion most typically employed in cure manufacture, powder was the most widely used preparation method.

These findings underline the necessity of additional pharmacological and phytochemical research to pinpoint bioactive substances, evaluate their therapeutic efficacy, and look into any possible side effects. Future studies will also help medicinal plants be used in a safer and more extensive way. Additionally, by highlighting the value of conserving traditional knowledge and encouraging the sustainable use of plants, they could influence national and local policy on healthcare and biodiversity conservation. Future research should take into account the limitations of this study, which include the seasonal availability of some plant species and the reliance on informants' memory.

Conflict of interest

The authors declare no conflict of interest.

Authors' Declaration

The authors hereby declare that the work presented in this article are original and that any liability for claims relating to the content of this article will be borne by them.

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