Ethnobotanical knowledge and quantitative evaluation of medicinal plants in the Dahra Region, Northwestern Algeria

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Research

Abstract

Background: This ethnobotanical investigation documents and analyzes traditional medicinal knowledge in the Dahra region of northwestern Algeria.

Methods: Data were collected from 420 informants across 11 municipalities using semi-structured interviews. Sociodemographic analysis revealed that traditional medicine remains widely practiced across educational and urban–rural boundaries, with women serving as principal custodians of household phytotherapeutic knowledge. Quantitative ethnobotanical indices, Informant Consensus Factor (ICF), Use Value (UV), Relative Frequency of Citation (RFC), and Fidelity Level (FL %), were applied to assess the cultural importance and reliability of recorded species.

Results: A total of 45 medicinal plants belonging to 23 botanical families were identified. The Lamiaceae family predominated (28.9%), followed by Apiaceae (11.1%) and Asteraceae (8.9%), reflecting a preference for aromatic taxa rich in essential oils, terpenoids, and flavonoids. Leaves were the most frequently used organs (≈ 50%), while decoction and infusion were the dominant preparation methods. High ICF values for respiratory (0.87), digestive (0.83), and immunity-related (0.81) disorders. Among individual taxa, *Origanum vulgare* (UV = 0.51; RFC = 30.2%), *Mentha spicata* (UV = 0.35), and *Foeniculum vulgare* (UV = 0.07) emerged as cultural keystone species, illustrating both pharmacological relevance and symbolic significance. Several species exhibited perfect fidelity (FL = 100%), notably *Citrullus colocynthis*, *Arbutus unedo*, and *Melissa officinalis*, confirming their recognized specificity and therapeutic reliability.

Conclusions: Overall, the Dahra ethnopharmacopoeia represents a dynamic, adaptive knowledge system in which ecological adaptation, cultural continuity, and empirical efficacy converge.

Keywords: Ethnobotany; Traditional medicine; Valorization; Quantitative indices; Dahra region; Algeria

Background

Over the recent decades, and despite the progress and achievements of modern medicine, traditional medical practices continue to play an indispensable role in healthcare systems, particularly in developing regions of Africa, Asia and Latin America (Kasilo *et al.* 2019, WHO-AFRO 2010). Up to 80% of Africans depend primarily on traditional remedies for their health needs (Sato 2012, WHO 2010). This continued reliance reflects the effectiveness, affordability, accessibility, and cultural relevance of plant-based therapies (Aremu *et al.* 2024, Gitima *et al.* 2025, Haider 2023, Muthu *et al.* 2006). Traditional medicine is intricately linked to the cultural, spiritual, and historical identity of many communities (Belhouala & Benarba 2021, Liu *et al.* 2013). It encompasses a wide range of practices, beliefs, and skills based on the use of plant, animal, and mineral resources, combined with manual and spiritual therapies aimed at maintaining health and treating diseases (Bodeker & Kronenberg 2002). Ethnobotany, which examines the relationships between people and plants, plays a vital role in recording and analyzing this ancestral knowledge (Nolan & Turner 2011, Saensouk *et al.* 2025). Through ethnobotanical research, scientists gain insight into how communities utilize plant diversity for food, medicine, shelter, and other necessities, while also identifying potential leads for modern drug discovery (Fuller 2013, Ram *et al.* 2004).

Globally, approximately 50,000 species of plants are recognized for their medicinal value, representing almost one-fifth of all known flora (Atanasov *et al.* 2015, Canter *et al.* 2005). More than 95% of traditional healing preparations are derived from plants (Tuasha *et al.* 2023, Usure *et al.* 2024), and around 50% of modern pharmaceuticals originate from natural compounds identified in these species (Davis & Choisy 2024, Pan *et al.* 2013). This underscores the enduring scientific and therapeutic significance of traditional knowledge. In Asian nations such as China, India, and Vietnam, traditional medicine systems that have evolved over centuries continue to influence global pharmacopoeia (Astutik *et al.* 2019, Liu 2021, Zamani *et al.* 2025). Likewise, in Africa, the widespread use of medicinal plants persists, driven by cultural heritage and the limited availability of modern healthcare facilities (Abdullahi 2011, Mahomoodally 2013).

In Algeria, traditional medicine retains a strong presence within the healthcare landscape. Nearly four-fifths of the population use herbal preparations for therapeutic purposes, a practice shaped by Berber, Maghrebian, and Arab-Muslim medical traditions (Baziz *et al.* 2020, Benarba 2016). The country's ecological and climatic diversity, from Mediterranean coastlines to Saharan plateaus, supports a rich flora estimated at nearly 4000 species, including 2500 in its northern region, 10% of which are endemic, of which more than 600 possess known medicinal or aromatic properties (Benchohra *et al.* 2025, Boulfous 2025). Despite this botanical wealth, ethnobotanical knowledge in Algeria remains insufficiently explored and is increasingly threatened by deforestation, habitat degradation, overharvesting, agricultural expansion, modernization and urbanization (Saidi *et al.* 2023), and the decline in oral transmission between generations (Baziz *et al.* 2020, Vela 2018).

Ethnobotanical investigations are therefore crucial for the preservation and revitalization of traditional wisdom. They provide valuable data on how local populations perceive, manage, and utilize plant resources, while also identifying bioactive compounds that can form the basis of new pharmaceutical products. Moreover, these studies contribute to biodiversity conservation and promote the sustainable use of natural resources. By bridging ancestral knowledge with modern science, ethnobotanical research enhances cultural heritage preservation and supports the global development of safe, effective, and affordable natural medicines.

In this context, the present study sought to document, preserve, and promote ethnomedicinal knowledge in one of Algeria's most floristically rich regions. This initiative aims not only to enhance healthcare and protect traditional heritage, but also to advance socioeconomic development and contribute to environmental sustainability.

Materials and Methods

Study area

The Dahra region, forming part of the mountainous Tell Atlas, is located in the northern sector of Chlef Province, northwestern Algeria, between latitudes 36°20′30″ and 36°28′00″ N and longitudes 0°53′00″ and 01°07′00″ E (Fig. 1). The area displays a rugged and diverse topography, characterized by mountainous and hilly terrain with elevations ranging from sea level to approximately 860 m. Notably, about 72 % of the region lies above 300 m in altitude. Slopes vary from 0° to 99.3°, with nearly 69 % of the terrain exhibiting gradients steeper than 20°. The landscape shows a gradual transition from wild coastal strips and beaches in the north to forested slopes, valleys, and agricultural lands further inland.

Climatically, the region is classified as Mediterranean semi-arid, marked by hot, dry summers and mild, wetter winters. Annual rainfalls are highly irregular, varying between 356 mm and 1112 mm, with an average of approximately 566 mm

(Taibi *et al.* 2019). The mean annual temperature is around 20.3 °C, while summer temperatures frequently reach 30 °C or higher. The dry season typically extends for about five months.

Forests in the Dahra region cover an estimated 11,300 ha and are particularly vulnerable to recurrent summer wildfires. The dominant vegetation is composed of *Pinus halepensis* Mill., *Quercus ilex* L., *Pistacia lentiscus* L., and *Quercus suber* L., species characteristic of Mediterranean ecosystems and well adapted to periodic fire disturbance.

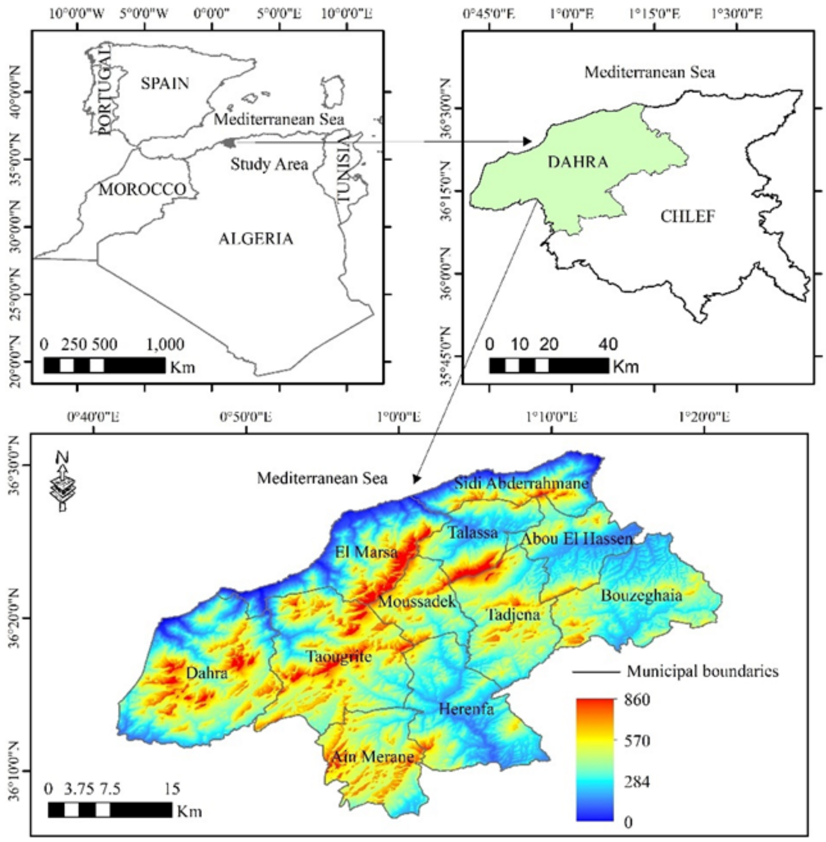

Figure 1. Location of the study area

Ethnobotanical Data Collection and Quantitative Analysis

A total of 420 informants, comprising 170 men and 250 women aged over 20 years, were randomly selected from 11 municipalities within the Dahra region: Sidi Abderrahmane, Abou El Hassen, El Marsa, Talassa, Bouzeghaia, Tadjena, Moussadek, Taougrite, Dahra, Herenfa, and Ain Merane. Data collection was conducted through semi-structured interviews using randomized visits to households, markets, mosques, hospitals, parks, and other public areas across the study zone. We followed the conventional ethnobotanical data collection procedure outlined by Albuquerque *et al.* (2014) and Meddour *et al.* (2022).

The interviews aimed to document comprehensive ethnobotanical knowledge, including vernacular plant names, therapeutic uses, plant parts utilized, preparation techniques, modes of administration, and dosage forms. Each recorded plant species was taxonomically identified according to its vernacular name using the guide of Algerian flora by Quezel and Santa (1962-1963).

Additionally, detailed sociodemographic data were collected for each participant, encompassing age, gender, educational level, and occupation. All statistical analyses and quantitative assessments were performed using Microsoft Excel.

Relative Frequency of Citation (RFC %): This index evaluates the popularity or recognition of each species within the community (Tardío & Pardo-de-Santayana 2008) :

$$RFC=FC/N\times100$$

Where FC is the number of informants who mentioned the species, and N is the total number of informants. Higher RFC values reflect greater cultural significance and local awareness of the plant.

Use Value (UV): This index assesses the relative importance and versatility of a plant species, based on the number of uses reported and the number of informants who cited it (Phillips & Gentry 1993):

$$UV=\sum Ui /N$$

Where U_i represents the number of use-reports for a given species by each informant, and N is the total number of informants interviewed. A higher UV indicates that a species is well-known and widely used within the community.

Informant Consensus Factor (ICF): This index measures the degree of agreement among informants regarding the use of plants to treat specific disease categories (Heinrich *et al.* 1998).

$$ICF= (Nur-Nt)/ (Nur-1)$$

Where $N_{(ur)}$ is the total number of use-reports for a particular ailment category and N_t is the number of taxa used for that category. ICF values range from 0 to 1, with higher values indicating stronger consensus among informants.

Fidelity Level (FL %): This index quantifies the specificity of plant use by determining the proportion of informants who report the same principal use of a given species. It was calculated following Heinrich *et al.* (1998), Tardío & Pardo-de-Santayana (2008) and Gazzaneo *et al.* (2005):

$$FL\ (\%) =Np/N\times100$$

Where N_p is the number of informants mentioning the use of a plant for a specific ailment and N is the total number of informants citing that plant for any ailment. High FL values indicate that a plant is widely recognized for treating a particular disease, reflecting strong cultural importance and healing reputation.

Results

Sociodemographic analysis

Among the 420 individuals interviewed in this ethnobotanical survey, 59.52% were women and 40.48% were men. The calculated sex ratio was 147, indicating that for every 100 men using phytotherapy, there were approximately 147 women. This predominance of female participants suggests that women play a more active role in traditional medicinal practices, likely reflecting their responsibilities in family healthcare, domestic management, and the preservation of local knowledge within the study communities.

The mean age of female informants was 31.98 years, compared to 38.81 years among male informants, showing that men were, on average, older. A z-test confirmed that this difference was highly significant ($p < 0.0001$), implying that age-related or gender-based differences may influence the level of experience, transmission, or participation in ethnobotanical knowledge systems.

With regard to educational background, the majority of participants had attained either secondary (37.20%) or university-level education (40.82%), while smaller proportions had completed intermediate (16.91%) or elementary education (4.59%), and only 0.48% had no formal education. These results indicate that ethnobotanical knowledge is not restricted to less-educated individuals but is also maintained among educated segments of the population, reflecting its cultural depth and continuity across social strata.

In terms of marital status, 62.80% of respondents were married, while 37.20% were single. This distribution suggests that married individuals, often responsible for family well-being, may be more frequently engaged in the preparation and use of traditional remedies.

Finally, analysis of residential distribution revealed that 71.74% of informants resided in urban areas, while 28.26% were from rural zones. This demonstrates that the use of traditional medicine in the Dahra region transcends the rural–urban divide, remaining culturally significant even among urban populations, possibly due to longstanding traditions and enduring trust in phytotherapeutic practices.

Quantitative Data analysis

Informant Consensus Factor

The Informant Consensus Factor (ICF) analysis provided valuable insights into the degree of agreement among informants regarding the use of medicinal plants for specific ailment categories in the region of Dahra. The ICF values ranged from 0.00 to 0.87 (Table 1), revealing substantial variation in consensus across therapeutic categories. The highest level of agreement was observed for respiratory disorders (ICF = 0.87), followed by digestive disorders (0.83) and infections or immunity-related ailments (0.81). These elevated values reflected a strong and cohesive body of ethnomedical knowledge within the local population, likely associated with the high prevalence and cultural importance of these conditions in the study area. The predominance of respiratory and digestive ailments in Mediterranean–North African contexts, often linked to climatic fluctuations and dietary habits, may explain the convergence of traditional remedies for these conditions. Relatively high consensus values were also recorded for nervous system disorders (0.79), reproductive disorders (0.73), hair and nail issues (0.67), and skin conditions (0.62). Although knowledge within these categories remained well structured, the slightly lower ICF values suggested some variability in plant selection or preparation methods. Such differences might have arisen from gender-specific expertise, disparities in species availability, or the coexistence of multiple traditional therapeutic practices within the community. Conversely, lower ICF values were obtained for endocrine/metabolic (0.44) and urinary disorders (0.33), reflecting either limited consensus among informants or greater diversity in plant use. The lowest levels of agreement were recorded for musculoskeletal and parasitic diseases, as well as for blood and dental disorders. These findings suggested that such ailments were either infrequently treated with medicinal plants or that the corresponding ethnomedical knowledge was fragmented or less effectively transmitted across generations.

Table 1. Informant Consensus Factor (ICF) analysis showing the number of use reports (Nur), taxa (Nt), and consensus values for medicinal plants employed in diverse therapeutic categories.

ICF	Nur	Nt	ICF
Digestive Disorders	202	36	0.83
Respiratory Disorders	197	26	0.87
Cardiovascular Disorders	14	11	0.23
Skin Conditions	38	15	0.62
Endocrine/Metabolic	17	10	0.44
Urinary Disorders	7	5	0.33
Reproductive Disorders	49	14	0.73
Nervous system	35	8	0.79
Infections/Immunity	63	13	0.81
Musculoskeletal	6	5	0.20
Parasites	6	5	0.20
Blood disorders	1	1	0.00
Dental	2	2	0.00
Hair/Nails	10	4	0.67
Others/General	11	8	0.30

Medicinal plants

A total of 45 medicinal plant species (Table 3) belonging to 23 botanical families (Fig. 2) were documented as therapeutically significant in the Dahra region. The Lamiaceae family was the most dominant, representing 28.9% of all recorded taxa, with key species including *Origanum vulgare*, *Mentha spicata*, *Rosmarinus officinalis*, *Salvia officinalis*, and *Lavandula stoechas*. This marked predominance highlights its pivotal role in local traditional medicine and aligns with its global prominence as a family rich in aromatic and bioactive compounds such as essential oils, flavonoids, and terpenoids. The Apiaceae family ranked second, accounting for 11.1% of the total species. It comprised *Foeniculum vulgare*, *Cuminum cyminum*, *Petroselinum crispum*, *Pimpinella tragium*, and *Bunium incrassatum*. This family is well recognized for its aromatic seeds, which are widely used in herbal medicine. The Asteraceae family followed, representing 8.9% of the species, and included *Matricaria chamomilla*, *Chrysanthemum parthenium*, and *Carthamus caeruleus*. Other families represented by two species each (4.4%) included the Cucurbitaceae (*Citrullus colocynthis*, *Ecballium elaterium*), Cupressaceae (*Juniperus oxycedrus*, *Tetraclinis articulata*), and Rhamnaceae (*Rhamnus alaternus*, *Zizyphus lotus*). Although these families exhibited lower species richness, they played specialized therapeutic roles within local pharmacopoeias. The remaining 17 families were represented by a single species each, indicating highly specific or localized medicinal uses within the community. Leaves were the most frequently utilized plant part (Fig. 3), accounting for approximately 50% of all cited uses. This preference is likely linked to their accessibility, renewability, and high content of bioactive secondary metabolites such as phenolics, flavonoids, and terpenoids. Seeds and roots were also widely used (11.11%), particularly in species such as *Cuminum cyminum*, *Foeniculum vulgare*, and *Arbutus unedo*, known for their concentrated phytochemical reserves. Flowers (e.g., *Matricaria chamomilla*), fruits (*Punica granatum*, *Citrullus colocynthis*), and stems were employed less frequently (7.41%), often for more specialized therapeutic purposes. Regarding preparation techniques (Fig. 4), decoction and infusion were the predominant methods, together accounting for about 74.68% of all reported uses. These water-based extraction techniques are simple, practical, and effective, reflecting a deep empirical understanding of the solubility of active compounds in traditional pharmacognosy. Decoction was primarily used for tougher plant materials such as roots, stems, and mature leaves (e.g., *Rhamnus alaternus*, *Juniperus oxycedrus*), while infusion was preferred for softer and more delicate organs such as young leaves and flowers (e.g., *Origanum vulgare* , *Matricaria chamomilla*). Less frequent preparation methods included maceration, applied to seeds and roots (*Capparis spinosa*, *Nigella arvensis*, *Salvia officinalis*) to preserve thermolabile constituents, and natural (raw) applications, observed in species such as *Citrullus colocynthis*, *Ecballium elaterium*, and *Chamaerops humilis*, where fresh or crushed materials were directly applied for rapid therapeutic action. The predominance of chamaephytes and hemicryptophytes highlights a flora well adapted to the Mediterranean semi-arid climate of the Dahra region (Fig. 5). The coexistence of phanerophytes and geophytes indicates the persistence of woody and perennial elements, while the presence of therophytes underscores anthropogenic and seasonal dynamics in plant distribution. This biological spectrum thus reflects a balanced combination of ecological resilience and ethnobotanical utility, showing how local populations have drawn upon a flora finely tuned to the region’s environmental constraints to develop a rich and sustainable traditional medical system.

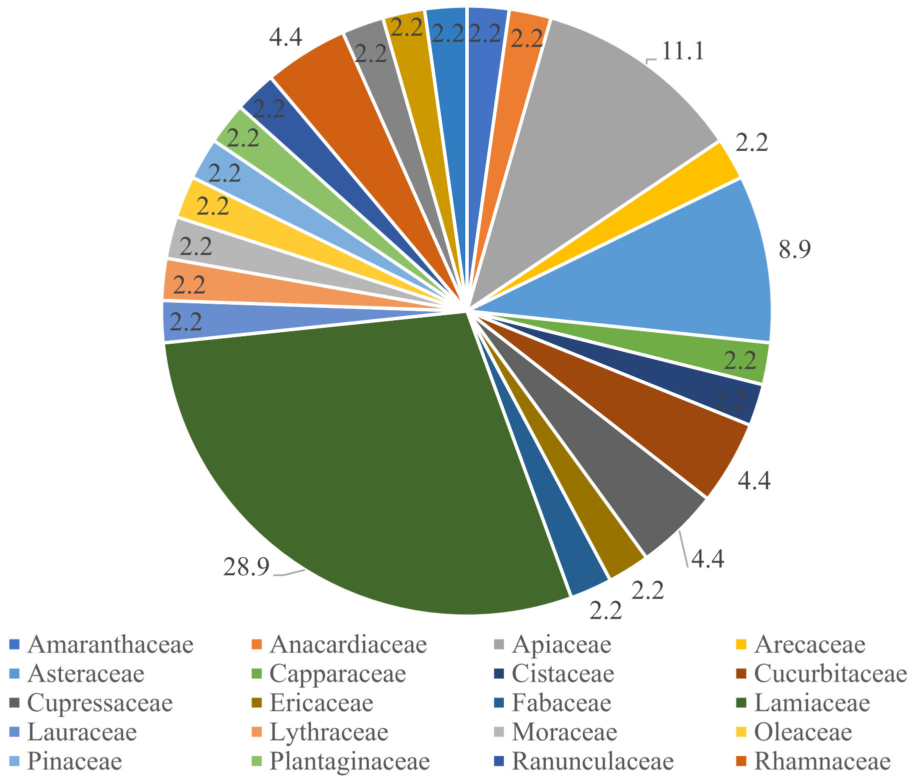

Figure 2. Proportion of medicinal plant families identified in the Dahra region

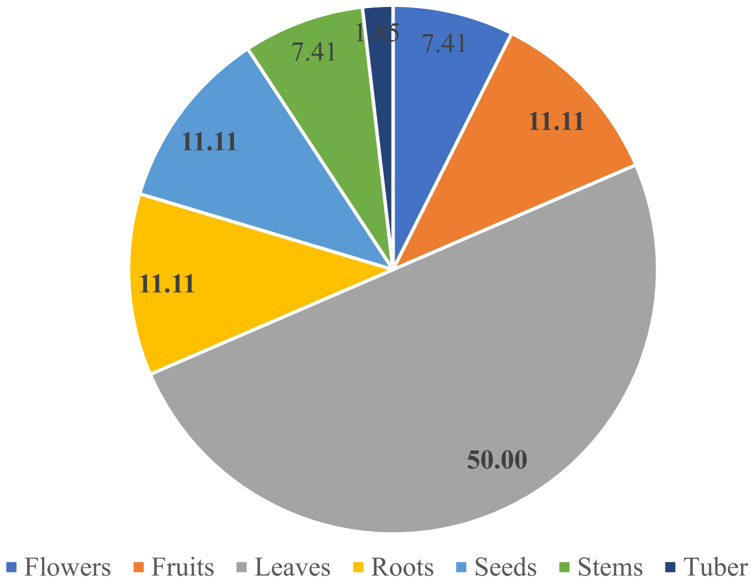

Figure 3: Frequency of plant parts used in traditional medicine in the Dahra region

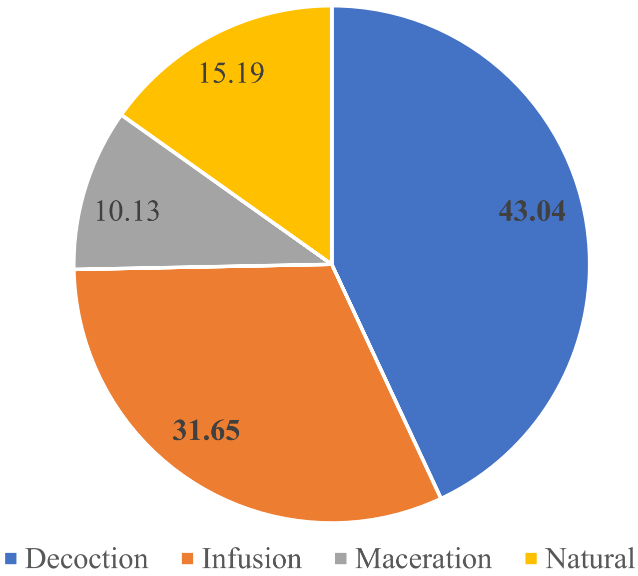

Figure 4: Frequency of preparation methods used for medicinal plants in the Dahra region

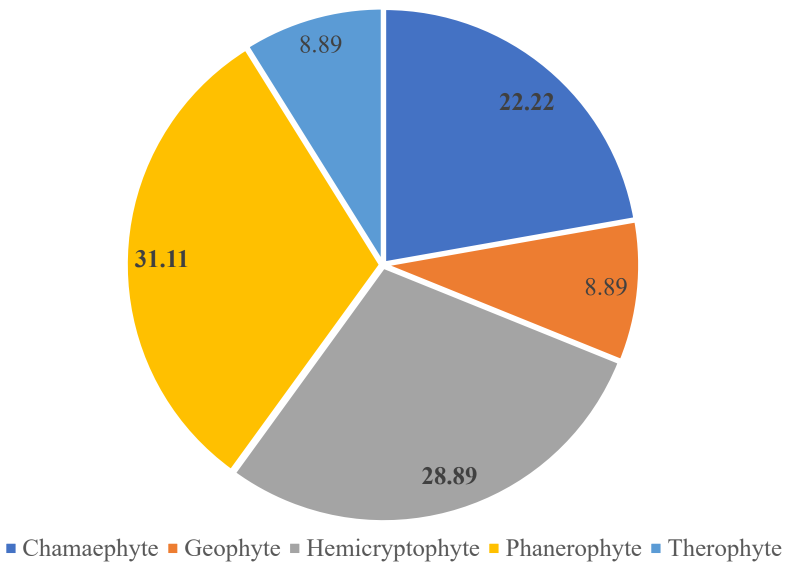

Figure 5: Proportion of biological types of medicinal plants in the Dahra region

Use Value

The Use Value (UV), which reflects both the cultural importance and frequency of use of each plant species, ranged from 0.002 to 0.509 (Table 2), indicating considerable variation in ethnomedicinal prominence among taxa. The highest UV was recorded for *Origanum vulgare* (UV = 0.51), highlighting its wide therapeutic spectrum and emphasizing its biochemical versatility as well as its symbolic cultural significance. The frequent citation of *Mentha spicata* (UV = 0.35) further reinforces the pivotal role of Lamiaceae species in local traditional medicine. Similarly, *Foeniculum vulgare* (UV = 0.069) displayed a broad range of medicinal uses, underscoring its value as a multifunctional household remedy with strong cultural resonance. Species with moderate UV values, such as *Pistacia lentiscus* (UV = 0.0643) and Rosmarinus officinalis L. (UV = 0.05), revealed an important pattern of therapeutic overlap. These taxa are well known throughout the Mediterranean ethnobotanical tradition for their essential oil content and broad-spectrum pharmacological activities, including antimicrobial, antioxidant, and anti-inflammatory properties. A second cluster of species exhibited moderate to low UV values (0.02–0.04), including *Salvia officinalis*, *Atriplex halimus*, *Matricaria chamomilla*, and *Zizyphus lotus*. Although cited less frequently, these plants occupy specialized positions within the local pharmacopoeia. Their restricted yet targeted applications suggest a refined ethnopharmacological knowledge system, often transmitted through gendered or lineage-based channels. For instance, *Salvia officinalis* L. was traditionally employed in managing uterine disorders and inflammatory conditions, corroborating its scientifically validated estrogenic and anti-inflammatory properties. Likewise, *Atriplex halimus* was associated with the treatment of cyst-related and thyroid disorders, illustrating nuanced diagnostic and therapeutic insights within traditional health concepts. Plants with low UV values (< 0.02), such as *Olea europaea*, *Trigonella foenum-graecum*, *Marrubium vulgare*, and *Carthamus caeruleus*, though less frequently mentioned, retain cultural and medicinal significance owing to their targeted efficacy. At the lower end of the UV spectrum (≤ 0.01), species such as *Ajuga iva*, *Teucrium polium*, *Citrullus colocynthis*, and *Arbutus unedo* demonstrated highly specialized therapeutic roles. Although less frequently cited overall, their consistent and focused use suggests cultural validation and specialized ethnomedical expertise within defined therapeutic niches.

Relative Frequency Citation

The Relative Frequency of Citation (RFC) index, ranged between 0 and 30.24% (Table 2), reflecting how frequently each species was cited across all informant interviews and thus measures the degree of shared ethnobotanical knowledge within the community. The data clearly highlighted *Origanum vulgare* (RFC = 30.24%) as the most frequently cited medicinal species. This exceptional value underscores its centrality within the local pharmacopoeia and its symbolic importance in traditional healthcare practices. The high consensus around this species also suggests intergenerational transmission of ethnobotanical knowledge, reflecting both cultural stability and empirical efficacy recognized through long-term communal experience. The second most cited plant, *Mentha spicata* (RFC = 25.24%), further strengthens the dominance of the Lamiaceae family in local ethnomedicine. The next tier of species, *Foeniculum vulgare* (RFC = 5.48%), *Pistacia lentiscus* (RFC = 4.52%), and *Rosmarinus officinalis* (RFC = 3.57%), occupies an intermediate level of informant consensus. These species, widely recognized across the Mediterranean, are renowned for their broad therapeutic efficacy and aromatic profiles. *Foeniculum vulgare*, with its carminative, expectorant, and galactagogue properties, is a versatile household remedy, often prescribed for both digestive and respiratory ailments. *Pistacia lentiscus* and *Rosmarinus officinalis*, rich in essential oils and phenolic compounds, reflect a strong empirical foundation in local ethnopharmacology, being used for digestive, dermatological, and circulatory disorders. Their moderately high RFC values indicate that they are culturally salient but perhaps less ubiquitous than *Origanum* or *Mentha*, reflecting their specialized use. Species with RFC values ranging between 1–3%, such as *Atriplex halimus* L., *Salvia officinalis* L., *Matricaria chamomilla* L., and *Zizyphus lotus* (L.) Desf., showed consistent yet more localized patterns of recognition. These plants, while not universally cited, are key components of specific therapeutic traditions. Their moderate RFC levels suggest that they are part of a shared yet selective body of knowledge, often associated with gendered or age-specific health practices, and may reflect knowledge specialization within certain subgroups (elderly person, or pastoral communities). A large group of species with RFC values below 1% represents a reservoir of less commonly cited but ethnomedically relevant taxa.

Fidelity Level and ethnopharmacologicalrRelevance

The Fidelity Level (FL %) analysis provided an essential measure of the specificity and cultural reliability of medicinal plant use within the Dahra region. The results demonstrated a marked variability in FL, ranging from 25% to 100%, revealing a complex structure of ethnobotanical specialization and generalization. The highest FL values (100%), were recorded for *Arbutus unedo* L. (blood disorders), *Citrullus colocynthis* (L.) Schrad. (endocrine/metabolic disorders), and Melissa officinalis L. (digestive disorders). For instance, *Citrullus colocynthis* is known for its hypoglycemic and lipid-lowering properties, validating its use in metabolic disorders, while *Melissa officinalis* is widely recognized for its carminative and digestive properties. These findings suggest a strong convergence between traditional empirical knowledge and biomedical functionality. Several species also showed very high-fidelity levels (≥70%), notably *Foeniculum vulgare* (75.86%, digestive disorders), *Pimpinella tragium* (71.43%, digestive disorders), *Cuminum cyminum* (66.67%, digestive), *Rhamnus alaternus* (66.67%, infections/immunity), *Capparis spinosa* (66.67%, musculoskeletal), and *Juniperus oxycedrus* (66.67%, respiratory). These high values highlight clusters of cultural consensus around a few plant-disease associations, emphasizing areas of collective therapeutic confidence, particularly for digestive and respiratory illnesses. The predominance of the digestive category reflects both its cultural salience and the frequent occurrence of gastrointestinal ailments in Mediterranean populations, traditionally linked to diet and climatic factors. Moderately high FL values (50–66%) were observed in numerous species such as *Origanum vulgare* (50.93%, respiratory disorders), *Matricaria chamomilla* (50%, digestive), *Punica granatum* (50%, digestive), *Lavandula stoechas* (50%, respiratory), *Cistus ladanifer* (50%, skin), and *Ajuga iva* (50%, parasitic infections). These plants are culturally versatile but still exhibit strong primary associations with specific therapeutic domains. The high FL for *Ajuga iva* in treating parasites reflects a specialized ethnopharmacological niche, suggesting potential for further biochemical exploration. Interestingly, the dominance of certain ailment categories, particularly digestive, respiratory, and skin disorders, mirrors both ecological and sociocultural realities. These are the most recurrent health problems in Mediterranean regions, where herbal remedies have evolved to address everyday ailments linked to diet and environment. The frequent association of Lamiaceae and Apiaceae species with these disorders emphasizes the local pharmacopoeia's reliance on aromatic, essential-oil–producing plants known for antimicrobial, anti-inflammatory, and carminative effects.

Discussion

This ethnobotanical survey conducted in the Dahra region revealed a complex yet coherent structure of traditional medicinal knowledge, deeply embedded within the community's sociocultural fabric. The predominance of female informants (59.52%) underscores the central role of women as custodians of traditional health knowledge, a trend consistently observed in North African and Mediterranean ethnobotanical studies (Belhacini et *al. 2024*, Benarba *et al.* 2023, Guimbo *et al.* 2011, Hedidi *et al.* 2024, Karakaya *et al.* 2019, Ouarghidi *et al.* 2015, Voeks 2007). This gendered pattern likely reflects women's greater involvement in household health care, child rearing, and preparation of herbal remedies, ensuring the continuity of phytotherapeutic traditions across generations. The higher mean age of male informants (38.81 years) compared to females (31.98 years), together with the significant statistical difference ($p < 0.0001$), suggests an age–gender complementarity in knowledge transmission, where younger women sustain domestic practices while older men often hold specialized field or ecological knowledge related to plant collection, which was also reported by Guimbo et *al.* (2011) and Muller *et al.* (2014) in southwest Niger and Voeks (2007) in Brazil. Contrary to the notion that traditional medicine persists primarily among less-educated populations such as reported by Bruyere *et al.* (2016), Kacholi (2025) and Rinto *et al.* (2023), the findings demonstrate that over three-quarters of informants possessed secondary or university education, confirming that ethnobotanical knowledge in Dahra remains socially inclusive and culturally resilient. Educated individuals actively participate in the preservation and adaptation of phytotherapy, integrating empirical wisdom with modern health awareness. This reflects a dynamic coexistence between traditional and biomedical systems, characteristic of transitional societies where trust in natural remedies persists despite increased access to formal healthcare. In this regard, Marsland (2007) and Peltzer and Pengpid (2015) emphasized that these two systems seldom operate independently; rather, individuals tend to navigate between them, often employing both sequentially or simultaneously to address their health needs. Finaly, married individuals (62.80%) were more engaged in medicinal plant use, consistent with their roles in household healthcare and intergenerational knowledge transmission, which aligns with the most common findings regarding the social structure in traditional knowledge (Chance & Abdoul 2025, Torres-Avilez *et al.* 2016). From a therapeutic perspective, the high Informant Consensus Factor (ICF) values recorded for respiratory (0.87), digestive (0.83), and immunity-related disorders (0.81) demonstrate a strong communal agreement on plant selection for prevalent health problems. These results are consistent with patterns documented in other Mediterranean contexts, where climatic variability, dietary habits, and microbial exposure render such ailments recurrent (Alemu *et al.* 2024, Chauhan *et al.* 2020, Gherairia *et al.* 2025, Hedidi *et al.* 2024; Lemhadri *et al.* 2023, Karakaya *et al.* 2019, Ramdane 2015).

The high consensus levels indicate shared empirical validation of certain plant-based therapies, enhancing their cultural and pharmacological credibility. Conversely, lower ICF values for musculoskeletal, parasitic, and dental ailments may indicate either the rarity of these conditions or the erosion of associated ethnomedical knowledge due to biomedical substitution. The floristic composition of the Dahra pharmacopoeia further illustrates ecological adaptation and cultural selection. The dominance of Lamiaceae (28.9%), followed by Apiaceae (11.1%) and Asteraceae (8.9%), aligns closely with Mediterranean ethnobotanical patterns where aromatic species rich in essential oils, flavonoids, and terpenoids are favored for their antimicrobial and anti-inflammatory activities (Benarba *et al.* 2015, Bouiamrine *et al.* 2017, Boutaj 2024, Hedidi *et al.* 2024, Thiviya *et al.* 2022).

Table 2. Medicinal plants recorded in the study area, including their traditional uses and quantitative indices.

Family	**Voucher No.**	**Species**	**Local name**	**Plant Parts Used**	**Methods of Utilizations**	**Uses**	**UV**	**RFC%**
Amaranthaceae	AH-0727	*Atriplex halimus* L.	Guetaf	Leaves, Flowers	Decoction, Infusion	Cysts, Emollient, Thyroid Cysts, Ovarian Cysts, Colon	0.038	3.095
Anacardiaceae	PL-1782	*Pistacia lentiscus* L.	Dharw	Leaves, Fruits, Seeds	Decoction, Infusion, Maceration, Natural	Cough, Flu, Expectorant, Allergy, Burns, Tonic, Diarrhea, Cardiotonic, Stomach, Tonsillitis, Constipation, Facial acne, Fever, Toothaches	0.064	4.524
Apiaceae	BI-0010	*Bunium incrassatum* (Boiss.) Batt. & Trab.	Talghouda	Roots	Maceration, Natural	Cough, Allergy, Thyroid	0.026	1.667
Apiaceae	CC-0011	*Cuminum cyminum* L.	Kemoun	Seeds	Decoction, Infusion, Maceration	Stomach, Colon, Flatulence, Flu, Immunity, Wound care	0.021	1.191
Apiaceae	FV-1963	*Foeniculum vulgare* (Mill.) Gaertn.	Besbas	Seeds	Decoction, Infusion, Natural	Cough, Diuretic, Colon, Wound Care, Expectorant, Stomach, Bronchitis, Colic, Vomiting, Constipation, Flatulence, Menstrual pain	0.069	5.476
Apiaceae	PC-1997	*Petroselinum crispum* (Mill.) Nym.	Maàdnousse	Leaves	Decoction, Natural	Stomach, Urinary tract infections, Menstrual pain	0.014	0.476
Apiacea	PT-1998	*Pimpinella tragium* Vill.	El Yansun	Leaves, Seeds	Decoction, Infusion	Flatulence, colon, Stomach, Respiratory, Sedative	0.017	0.714
Arecaceae	CH-0449	*Chamaerops humilis* L.	Doum	Roots	Natural	Constipation, Diarrhea, Skin calluses, Diabetes, Blood pressure	0.012	0.476
Asteraceae	CC-3015	*Carthamus caeruleus* L.	Maghres Guers	Roots	Maceration	Burns, Wound care, Hair growth	0.017	1.191
Asteraceae	CP-0014	*Chrysanthemum parthenium* (L.) Pers.	Alaqhuan	Flowers	Decoction	Headaches, Fever	0.005	0.238
Asteraceae	MC-2826	*Matricaria chamomilla* L.	Babounedj	Flowers	Decoction, Infusion	Colon, Stomach, Flatulence, Menstrual pain, Hemorrhoids, Nerve pain, Fever	0.033	2.143
Asteraceae	RA-0015	*Rhaponticum acaule* (L.) DC.	Tafgha	Tuber	Natural	Anemia, Stomach	0.005	0.238
Capparaceae	CS-1040	*Capparis spinosa* L.	Kabar	Roots, Stems	Maceration, Natural	Joint pain, Herniated disc, Appetite stimulant	0.007	0.476
Cistaceae	CL-2057	*Cistus ladanifer* L.	Elkridha	Leaves	Natural	Wound care, Antibacterial, Diarrhea	0.01	0.476
Cucurbitaceae	CC-2686	*Citrullus colocynthis* (L.) Schrad.	El Hadj	Fruits	Natural	Diabetes	0.002	0.238

Cucurbitaceae	EE-2682	*Ecballium elaterium* Rich.	Fegous El Hamir	Fruits	Natural	Jaundice, Flu	0.005	0.238
Cupressaceae	JO-0048	*Juniperus oxycedrus* L.	Thaga	Fruits	Decoction	Bronchitis, Cough, Stomach	0.007	0.238
Cupressaceae	TA-0096	*Tetraclinis articulata* (Vahl) Mast.	Aârâr	Leaves	Decoction	Colic, Diarrhea, Cough, Rheumatism, Cardiac	0.012	0.476
Ericaceae	AU-2097	*Arbutus unedo* L.	Landj	Roots	Decoction	Anemia	0.002	0.238
Fabaceae	TF-1480	*Trigonella foenum-graecum* L.	Lhalba	Seeds	Decoction, Infusion, Natural	Weight gain, Blood pressure, Panic, Diabetes, Slimness, Stress, Stomach	0.019	0.952
Lamiaceae	AI-2213	*Ajuga iva* (L.) Schreb.	Chendgoura	Leaves	Infusion	Stomach worms, heart attacks, ulcer, diarrhea	0.01	0.714
Lamiaceae	LS-2333	*Lavandula stoechas* L.	Halhal	Leaves, Flowers	Decoction, Infusion	Bronchitis, Cough, Urinary tract infections, Stomach	0.01	0.476
Lamiaceae	MV-2415	*Marrubium vulgare* L.	Timeriwat	Leaves	Decoction, Natural	Menstrual pain, Uterine disorders, Stress, Diabetes, Eyes, Fever, Diarrhea	0.019	1.191
Lamiaceae	MO-2370	*Melissa officinalis* L.	Melissa	Leaves	Decoction, Infusion	Constipation, Colic	0.002	0.238
Lamiaceae	MP-2286	*Mentha pulegium* L.	Fliou	Leaves	Decoction, Infusion	Abdominal aches, Cough	0.005	0.238
Lamiaceae	MR- 2283	*Mentha rotundifolia* L.	Timarsad	Leaves	Decoction	Stomach, Flatulence, Tonic	0.007	0.238
Lamiaceae	MS-2284	*Mentha spicata* L. em. Huds.	Naanaa	Leaves	Decoction, Infusion, Natural	Stomach, Vomiting, Bloating, Diarrhea, Colon, Colic, Cough, Menstrual pain, Fever, Flu, Stress, Headaches, Nausea, Slimness	0.345	25.24
Lamiaceae	OM-2421	*Origanum majorana* L.	Merdagouche	Leaves	Decoction, Infusion	Stomach, Wound care, Blood pressure, Menstrual pain	0.019	1.191
Lamiaceae	RO-2314	*Rosmarinus officinalis* L.	Iklil El Djabel	Leaves, Stems	Decoction, Infusion, Maceration	Flatulence, Stomach, Diarrhea, Colon, Urinary, Respiratory, Immunity, Menstrual pain, Hair damage, Parasites, Hair loss, Allergy	0.05	3.571
Lamiaceae	SO-2317	*Salvia officinalis* L.	Marymia	Leaves	Decoction, Infusion, Maceration	Uterine disorder, Fibroids, Menstrual pain, Wound care, Colon, Stomach, External inflammation, Tonsillitis	0.038	2.857
Lamiaceae	SC-20035	*Satureja calamintha* Scheele	Nabta	Leaves	Decoction, Infusion	Flu, Cough, Fever, Parasites, Menstrual pain, Wound care, Stomach, Diarrhea	0.021	0.952

Lamiaceae	TP-2336	*Teucrium polium* L.	El Djaeda	Leaves	Infusion	Diabetes, Fever, Menstrual pain	0.007	0.238
Lamiaceae	OV-2420	*Origanum vulgare* L.	Zaâter	Leaves	Decoction, Infusion	Antibacterial, Asthma, Bloating, Blood pressure, Flu, Colic, Colon, Cough, Diarrhea, Fever, Infections, Menstrual pain, Panic, Stomach, Allergy, Asthma, Blood Pressure, Flatulence, Post-Partum, Uterine cleaning	0.51	30.24
Lauraceae	LN-1004	*Laurus nobilis* L.	Rend	Leaves	Decoction, Infusion	Cough, wound care, Stomach, Blood pressure, Parasites	0.014	0.714
Lythraceae	PG-1855	*Punica granatum* L.	Romane	Fruits	Decoction	Stomach, Diarrhea, Toothaches, Parasites	0.01	0.476
Moraceae	MN- 0696	*Morus nigra* L.	Awraq Altout	Leaves	Decoction	Stomach, Cough, Blood pressure	0.007	0.238
Oleaceae	OE-2157	*Olea europaea* L.	Zitoune	Leaves	Decoction, Infusion	Diabetes, Eczema, Cough, Blood pressure, Constipation	0.019	0.952
Pinaceae	PH-0055	*Pinus halepensis* Mill.	Snawber	Fruits	Decoction	Wound care, Stomach, Cough	0.01	0.476
Plantaginaceae	GA-2568	*Globularia alypum* L.	Tasslegha	Leaves, Stems	Decoction	Rheumatism, Depurative	0.005	0.238
Ranunculaceae	NA-0966	*Nigella arvensis* L.	Sanoudj	Seeds	Infusion, Maceration	Stomach, Flatulence, Blood pressure, Menstrual pain, Cough	0.012	0.476
Rhamnaceae	RA-1796	*Rhamnus alaternus* L.	Meliles	Roots	Decoction	Jaundice, Skin conditions, Stomach	0.014	0.952
Rhamnaceae	ZL-1802	*Zizyphus lotus* (L.) Desf.	Sedra	Leaves	Decoction, Infusion	Hair loss, Diarrhea, Diabetes, Headaches, Bronchitis, Stomach, Articular pain	0.036	1.667
Rosaceae	CA-0007	*Crataegus azarolus* L.	Zaarour	Leaves	Decoction	Heart diseases, Diabetes	0.005	0.238
Rutaceae	RC-1726	*Ruta chalepensis* L.	Fidjel	Leaves, Stems	Decoction, Infusion	Uterine, congestion, Muscle pain	0.01	0.714
Urticaceae	UD-0702	*Urtica dioica* L.	Horig	Leaves	Decoction, Infusion	Kidney, Urinary, Bedwetting, Skin conditions, Allergy	0.014	0.714

These families are not only chemically versatile but also sensorially salient, with characteristic aromas and flavors that facilitate recognition and trust. The presence of families represented by two species, such as Cucurbitaceae, Cupressaceae, and Rhamnaceae, reflects more specialized therapeutic niches, while single-species families highlight the breadth of ethnomedicinal diversity sustained within local ecological limits reflecting specialized or limited use within local communities (Saensouk *et al.* 2025). The predominance of leaf use (50%) reflects both practical and ecological considerations, leaves are accessible, renewable, and biochemically rich, minimizing ecological impact compared to root harvesting, these the findings align with those of Chauhan *et al.* (2020) in India and De Wet (2010) in South Africa. The preference for water-based preparations (infusion and decoction, almost 70%) underscores pragmatic ethnopharmacological knowledge about solvent efficacy and compound stability. These techniques mirror practices across Africa and Middle East, where simplicity, cost-effectiveness, and accessibility underpin the endurance of traditional remedies (Barkaoui *et al.* 2017, Hlatshwayo *et al.* 2025, Ullah *et al.* 2020). The Use Value (UV) analysis revealed substantial variation in the ethnomedicinal prominence of taxa, with *Origanum vulgare* (UV = 0.51) and *Mentha spicata* (UV = 0.35) emerging as core cultural keystone species. Their high UV and RFC values attest to both empirical efficacy and cultural symbolism, reinforcing their roles in daily healthcare and ritual practice. Similarly, *Foeniculum vulgare* (UV = 0.069) occupies a multifunctional position in domestic phytotherapy, bridging digestive and respiratory treatments. From an analytical perspective, the clustering and concentration of high-UV taxa within a few dominant families, particularly Lamiaceae and Apiaceae, reflect a culturally selective pattern of medicinal plant use. This pattern appears to be guided by sensory familiarity, phytochemical efficacy, and ecological availability, demonstrating a profound convergence between environmental knowledge and cultural preference that typifies Mediterranean ethnobotanical systems (Savo *et al.* 2015, Shepard 2004). Species with moderate UV values, *Pistacia lentiscus* and *Rosmarinus officinalis*, reflect regional ethnobotanical continuity across the Mediterranean, while low-UV taxa such as *Olea europaea* and *Trigonella foenum-graecum* retain symbolic and therapeutic resonance despite lower citation frequencies. Their continued mention reveals cultural persistence and selective memory of highly efficacious plants. The Fidelity Level (FL%) findings further validated these trends, with *Citrullus colocynthis*, *Arbutus unedo*, and *Melissa officinalis* achieving 100% fidelity, reflecting both pharmacological reliability and cultural trust. High FLs in *Foeniculum vulgare*, *Pimpinella tragium*, and *Rhamnus alaternus* demonstrate strong agreement on their therapeutic domains, particularly for digestive and respiratory disorders, conditions long treated with aromatic, essential-oil–producing species. Such alignment between traditional use and pharmacological activity underscores the empirical sophistication of local ethnomedicine (Mahapatra *et al.* 2019, Nna *et al.* 2024).

Conclusion

The ethnobotanical landscape of the Dahra region exemplifies a resilient and adaptive knowledge system where cultural continuity, ecological pragmatism, and empirical validation intersect. This survey reveals a coherent body of traditional medicinal knowledge deeply embedded in the community's sociocultural and ecological framework. The predominance of women as informants highlights their central role in the preservation and transmission of phytotherapeutic knowledge, while the observed age–gender complementarity reflects a balanced distribution of domestic and ecological expertise. The active engagement of educated individuals demonstrates that traditional medicine remains socially inclusive and dynamically integrated with biomedical practices rather than opposed to them.

High Informant Consensus Factor (ICF) values for respiratory, digestive, and immunity-related ailments underscore a strong communal agreement on therapeutic efficacy, reflecting the empirical soundness of the local pharmacopoeia. The dominance of Lamiaceae, Apiaceae, and Asteraceae families further illustrates ecological adaptation and sensory preference, emphasizing the role of aromatic and bioactive species in cultural selection. Quantitative indices such as Use Value (UV) and Fidelity Level (FL %) confirm the prominence of *Origanum vulgare*, *Mentha spicata*, and *Foeniculum vulgare* as cultural keystone species, supported by high community trust and pharmacological relevance. Altogether, the convergence of high informant consensus, selective floristic representation, and alignment with known pharmacological activities demonstrates that Dahra's traditional pharmacopoeia remains a living heritage—culturally coherent, scientifically relevant, and rich in potential for future ethnopharmacological and biodiversity research.

Declarations

Ethics approval and consent to participate: Before beginning the ethnobotanical study, we obtained verbal consent from all participants.

Consent for publication: Not applicable

Availability of data and materials: The data featured in this manuscript can be obtained from the corresponding author.

Competing interests: It is stated by the author that they do not possess any conflicting interests.

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Author contributions: H.K.O. conducted the ethnobotanical survey, processed the data, and wrote the first version of the manuscript. R.M.D. & A.Z. prepared the questionnaire and collected the data. F.S. identified the plant species and directed the ethnobotanical survey. A.A. monitoring data collection and analysis, helping with discussions, produced the location map, and contributed to the revision of the final version of the text.

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