



Traditional use of medicinal plants for Gastrointestinal Disorders: An Ethnobotanical study in Northern Tunisia

Samar Hamrouni, Jamila Ben Salem, Chahrazed Jaffali, Ayda Khadhri, Chedia Aouadhi

Correspondence

Samar Hamrouni^{1,2}, Jamila Ben Salem², Chahrazed Jaffali², Ayda Khadhri², Chedia Aouadhi^{1,3*}

¹University of Tunis El Manar (UTM), Pasteur Institute of Tunisia, Laboratory of Epidemiology and Veterinary Microbiology, Group of Bacteriology and Biotechnology, BP 74, 13 place Pasteur, Belvedere, 1002, Tunis, Tunisia

²University of Tunis El Manar, Faculty of Sciences, Plant, Soil, Environment Interactions Laboratory, Campus Academia, 2092 Tunis, Tunisia.

³University of Jendouba, Higher Institute of Biotechnology of Beja (ISBB), Habib Bourguiba Avenue, P.O. Box 382,9000 Beja, Tunisia.

*Corresponding Author: chediaaouadhi@yahoo.fr

Ethnobotany Research and Applications 30:50 (2026) - <http://dx.doi.org/10.32859/era.30.50.1-10>

Manuscript received: 17/10/2025 - Revised manuscript received: 17/02/2026 - Published: 18/02/2026

Research

Abstract

Background: In rural areas of Tunisia and the wider Maghreb, where public healthcare services are limited and often expensive, traditional medicinal plants play a crucial role as primary and accessible sources of healthcare. They are particularly used to treat common gastrointestinal disorders such as gastroenteritis. Despite their importance, ethnobotanical knowledge in these regions remains insufficiently documented.

Methods: An ethnobotanical survey was conducted in El Hamra, Amdoun region (Béja governorate, Tunisia) to collect and document data on the use of medicinal plants for the treatment of gastroenteritis. A total of 100 participants were interviewed using a well-structured questionnaire. The investigation focused on sociodemographic characteristics, the most frequently cited plant species, the parts of plants used, preparation methods, and the sources of traditional knowledge.

Results: The findings revealed that women (57%) and young adults aged 20-30 years (33%) are the primary users of medicinal plants. *Myrtus communis* (52%) and *Pistacia lentiscus* (35%) were the most commonly cited species used against gastroenteritis. Leaves were the dominant plant parts employed (90%), typically prepared as decoctions (83%). Personal experience was identified as the main source of knowledge (45%), followed by the internet (30%) and reading (25%), indicating an interaction between traditional and modern information channels.

Conclusions: This study highlights the ongoing relevance and transmission of ethnopharmacological knowledge in northern Tunisia. The frequent use of specific species across different regions emphasizes their potential for pharmacological investigation and sustainable exploitation. Overall, the documentation and validation of these traditional practices contribute to the preservation of local cultural heritage and support the development of new therapeutic resources derived from regional flora.

Keywords: Ethnobotany, gastroenteritis, medicinal plants, *Myrtus communis*, *Pistacia lentiscus*, Tunisia

Background

Traditional medicine has long been, and continues to be, recognized as a keystone for advancing scientific research into novel therapeutic approaches, particularly in the context of increasing antimicrobial resistance and limited access to conventional healthcare in rural areas. In northern Tunisia, medicinal plants remain a cornerstone of primary healthcare, especially in rural communities where traditional knowledge is orally transmitted and empirically validated through long-standing practices (Ben Salah *et al.* 2019; Karous *et al.* 2021; Hamrouni *et al.* 2023; Taouii *et al.* 2026). These traditional remedies are particularly important for the management of common and easily treated ailments such as gastroenteritis, due to their wide availability, affordability, perceived effectiveness, and strong cultural acceptance within household healthcare strategies (Hayat *et al.* 2020; Tadesse *et al.* 2022; Lyoussi *et al.* 2023). Recent ethnopharmacological studies emphasize a renewed global interest in plant-based therapies for gastrointestinal disorders, driven by their multifunctional bioactive profiles and lower risk of adverse effects (Bencheikh *et al.* 2024; Tabouii *et al.* 2026).

Ethnobotanical surveys, typically based on semi-structured interviews, participant observation, and quantitative indices such as Use Value and Informant Consensus Factor, are essential tools for documenting medicinal plant diversity, usage patterns, and knowledge transmission routes within communities (Zerbo *et al.* 2025). Recent studies further highlight the role of these approaches in identifying key species for pharmacological validation and biodiversity conservation, as well as in assessing the influence of modern information sources (Internet and printed media) on traditional practices (Hayat *et al.* 2020; Karous *et al.* 2021; Bencheikh *et al.* 2024; Zerbo *et al.* 2025).

Local and regional studies conducted in Tunisia and neighboring Mediterranean and North African countries consistently report similar trends: leaves are the most frequently used plant part, decoction and infusion are the dominant preparation methods, and digestive system disorders rank among the most commonly treated ailment categories (Ben Salah *et al.* 2019; Hayat *et al.* 2020; Karous *et al.* 2021; Lyoussi *et al.* 2023). Recent ethnopharmacological reviews underline that, despite their widespread traditional use, many gastro-protective preparations still lack standardized dosage, toxicological assessment, and *in vivo* validation, reinforcing the need to focus on species with high consensus indices (Tadesse *et al.* 2022; Bencheikh *et al.* 2024; Tabouii *et al.* 2026).

Despite this growing body of regional research, the El Hamra area (Amdoun, Béja governorate) remains poorly documented from an ethnobotanical perspective. Its specific bioclimatic conditions, floristic richness, and local cultural heritage suggest the potential presence of underreported medicinal taxa or novel therapeutic uses that are not yet reflected in national inventories. Therefore, the present study aims to fill this gap by characterizing the sociodemographic profile of medicinal plant users, identifying the most frequently cited species used in the treatment of gastroenteritis, documenting plant parts and preparation methods, and analyzing knowledge sources and transmission pathways in the El Hamra area. This approach provides a robust and up-to-date evidence base for subsequent phytochemical, pharmacological, and toxicological investigations of high-value medicinal species.

Materials and Methods

Survey Design

An ethnobotanical survey was conducted in the region of El Hamra, Amdoun, Béja governorate, Tunisia, to document the traditional use of medicinal plants in the treatment of gastroenteritis. A total of 100 participants were inquired using a structured interview designed to collect detailed data on sociodemographic attributes (age, sex, and educational level), medicinal herb usage (species and plant part used, preparation method), and sources of ethnobotanical knowledge (personal experience, generation transfer, literature, and digital resources). Plant species cited by respondents were first identified based on local vernacular names and then taxonomically verified using standard floras and botanical references. The frequency of citation (FC) for each species, plant part, and preparation method was calculated as a percentage of total informants to quantify their relative importance.

Data Processing and Analysis

Data collected through the survey forms were compiled into a database and statistically processed using Microsoft Excel 2020 to generate tables and graphical representations. Sociodemographic characteristics were summarized through descriptive statistics (percentages and frequencies). Comparative analysis was also performed by referencing previously published ethnobotanical surveys from Tunisia, Morocco, and Algeria (Ben Salah *et al.* 2019, Hayat *et al.* 2020; Karous *et al.* 2021), allowing contextualization of the findings within regional traditional practices. All procedures adhered to ethical guidelines for ethnobotanical research, including obtaining prior informed consent from participants before data collection.

Ethnobotanical Indices

To assess the relative importance of the recorded species, the following quantitative indices were calculated:

Relative Frequency of Citation (RFC)

The RFC provides a measure of the local therapeutic significance of each plant species. It was calculated as:

$$RFC = FC/N$$

where FC is the number of participants citing a given species, and N is the total number of respondents. RFC values range from 0 to 1, with higher values indicating greater local importance.

Use Value (UV)

To evaluate the relative significance of a species based on the diversity of uses reported, the UV index was determined and calculated using the following formula:

$$UV = \sum U/N$$

Where U is the number of uses mentioned by each informant for a given species, and N is the total number of respondents. A higher UV indicates a plant species with a wider range of recognized applications.

Results and Discussion

Sociodemographic profile of respondents

As part of this study, an ethnobotanical survey was undertaken in the region of El Hamra, Amdoun (Béja governorate, Tunisia) in order to establish the main medicinal plants used in the treatment of gastroenteritis. A total of 100 individuals were interviewed.

Analysis of the age range revealed that the most represented group was that of respondents aged 20-30 years (33%), followed by the age groups 51-60 years (22%), 41-50 years (18%), and 31-40 years (14%), while individuals over 60 years old accounted for 12% of the sample (Fig. 1a). This finding suggests that both young adults and middle-aged individuals are actively involved in the use of medicinal plants, while the lower proportion of elderly respondents may reflect either reduced participation in surveys or the progressive erosion of traditional knowledge among the older generation. Similar age-related patterns have been reported in other Tunisian regions, such as Ouled Dabbeb and Djerba, where middle-aged and younger adults constitute the majority of informants (Ben Salah *et al.* 2019; Karous *et al.* 2021).

The sex distribution showed that women represented 57% of medicinal plant users for the treatment of gastroenteritis, compared with 43% men (Fig. 1b). This predominance of women is consistent with numerous ethnobotanical surveys across Tunisia and the Maghreb, where women are often considered as the primary custodians of valuable medicinal wisdom and traditional healing practices (Ben Salah *et al.* 2019; Karous *et al.* 2021). Their central role in plant collection, preparation, and administration underline the importance of gender in the preservation and transmission of ethnopharmacological knowledge across generations.

Concerning educational level, respondents with a university degree represented the largest proportion (31%), followed by illiterate individuals (27%), those with a secondary education level (26%), and finally those who had completed elementary education level (16%) (Fig. 1c). The complex interplay between highly educated and non-educated groups highlights the coexistence of two knowledge systems: one based on academic or formal learning and the other derived from oral transmission and traditional practices. Comparable findings were observed in Algeria and Morocco, where both illiterate and university-educated individuals upheld a key role in the safeguarding of the ethnobotanical knowledge (Bouasla & Bouasla 2017; Hayat *et al.* 2020).

Taking together, these results indicate that the use of medicinal plants in Amdoun spans different age groups, educational levels, and genders, confirming that ethnobotanical knowledge is not restricted to a single social category but rather shared across diverse segments of the population.

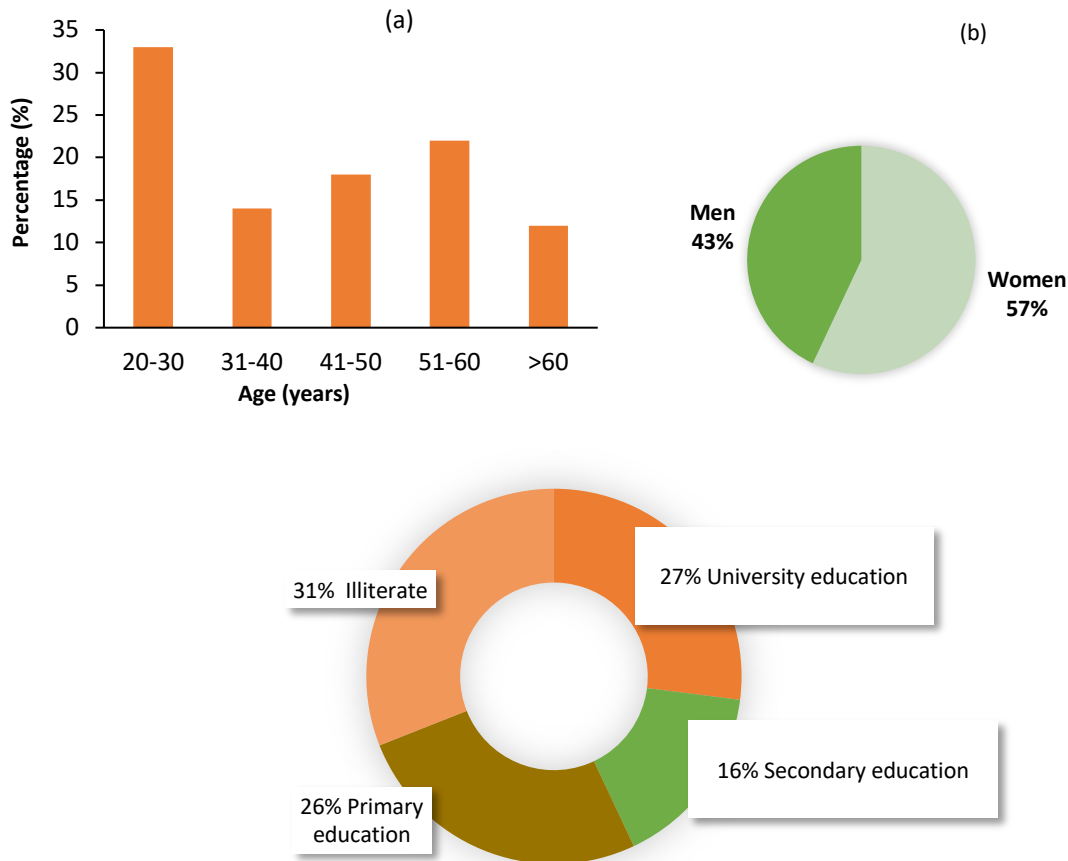


Figure 1. Sociodemographic profile of participants: age (a), sex (b) and profession (c)

Use of medicinal plants for the treatment of gastroenteritis

The survey identified several medicinal plants used by local communities in El Hamra, Amdoun, for the treatment of gastroenteritis (Table 1). Among these, *Myrtus communis* was the most frequently cited species, with a Relative Frequency of Citation (RFC) of 0.52 and a Use Value (UV) of 0.68 (Table 1). *Pistacia lentiscus* followed with RFC = 0.35 and UV = 0.42, whilst *Rosmarinus officinalis* (RFC = 0.08, UV = 0.10) and *Mentha* spp. (RFC = 0.05, UV = 0.06) were less mentioned.

In fact, *Myrtus communis* is widely recognized for its highly antimicrobial, antispasmodic, and anti-inflammatory properties, which alleviate digestive symptoms and help control intestinal infections (Hennia *et al.* 2019; Karous *et al.* 2021). According to the survey, the majority of respondents reported using *M. communis* (myrtle, 52%), followed by *P. lentiscus* (mastic tree, 35%), while *R. officinalis* (rosemary) and *Mentha* spp. (mint) together accounted for 13% of reported uses (Table 1).

Phytochemical and pharmacological evidence support their widespread uses. *Myrtus communis* contains flavonoids, phenolic acids, essential oils, and tannins that contribute to its antimicrobial, anti-inflammatory, and gastrointestinal protective properties (Al-Snafi *et al.* 2024). *In vivo*, studies showed that microencapsulated *M. communis* essential oil significantly protected gastric mucosa against ethanol/HCl-induced lesions by inhibiting oxidative stress and improving antioxidant defenses (Mansour *et al.* 2022).

Pistacia lentiscus is rich in terpenes (e.g., myrcene, α -pinene, limonene) and polyphenolic compounds such as gallic and quercetin derivatives, conferring notable antioxidant, antimicrobial, anti-inflammatory, and gastroprotective attributes (Yemmen *et al.* 2017; Milia *et al.* 2021; Bendada *et al.* 2024). Leaves, stems and fruits extracts have also demonstrated remarkable antioxidant activity and antiproliferative effects against gastrointestinal cancer cell lines *in vitro* (Yemmen *et al.* 2017).

Additionally, *Rosmarinus officinalis* has long been valued in traditional medicine for its carminative and antiseptic properties, useful in reducing digestive discomfort and intestinal spasms. Although most recent North African research does not focus

specifically on gastrointestinal disorders, its ethnobotanical relevance in the region remains well documented (De Oliveira *et al.* 2019; Huet *et al.* 2024).

Furthermore, *Mentha spp.* are commonly used worldwide for their antispasmodic and analgesic effects, providing relief from abdominal pain and supporting digestion (Al-Snafi *et al.* 2024).

The predominance of *M. communis* and *P. lentiscus* in this study aligns with other ethnobotanical surveys in the Maghreb. For instance, Karous *et al.* (2021) highlighted *M. communis* among the most cited species for digestive disorders in southern Tunisia, while Ben Salah *et al.* (2019) recorded frequent use of *P. lentiscus* in Djerba. Similarly, surveys in northeastern Morocco reported both plants as key remedies for gastrointestinal ailments (Hayat *et al.* 2020).

All together, these findings reflect a strong cultural consensus regarding the therapeutic effectiveness of *M. communis* and *P. lentiscus*, likely associated to their ecological availability and longstanding empirical validation. Given their recurrent citation across multiple regions, these medicinal plants emerged as promising candidates for pharmacological investigation and the development of standardized herbal preparations for evidence-based gastroenteritis management.

Table 1. Relative Frequency of Citation (RFC) and Use Value (UV) of medicinal plants used for gastroenteritis in El Hamra, Amdoun.

Species	FC (%)	RFC	U (%)	UV
<i>Myrtus communis</i>	52	0.52	68	0.68
<i>Pistacia lentiscus</i>	35	0.35	42	0.42
<i>Rosmarinus officinalis</i>	8	0.08	10	0.10
<i>Mentha spp.</i>	5	0.05	6	0.06

Plant parts used and mode of utilization

As illustrated in fig. 2, leaves are the most commonly employed constituents for the preparation of remedies, accounting for approximately 90% of reported uses. Furthermore, roots (6%) and aerial parts such as stems and flowers (4%) were also mentioned by the informants. The predominance of leaves could be further attributed to their abundance, ease of harvest without damaging the plant, and their higher content of secondary metabolites (polyphenols, flavonoids, essential oils), which confer various therapeutic properties.

These results corroborated numerous ethnobotanical surveys conducted in Tunisia and the Maghreb. In Ouled Dabbeb (southern Tunisia), Karous *et al.* (2021) reported that leaves accounted for 41% of plant parts used, while in Djerba, Ben Salah *et al.* (2019) observed a usage of 59%. Similarly, Hayat *et al.* (2020) reported that leaves displayed 54.8% over other plant parts in northeastern Morocco. Nonetheless, Bencheikh *et al.* (2024) confirmed that leaves were the major cited parts (57%) in an ethnobotanical survey of medicinal plants in northeastern Morocco, reflecting their pharmacological importance and ecological accessibility. Comparable results were also reported in Algeria, where leaves covered up to 62% of medicinal uses (Chermat & Gharzouli 2022). These convergences emphasize the importance of leaves as the primary therapeutic resource in traditional medicine across North Africa, revealing both cultural preferences and the phytochemical potential of leaf tissues.

Methods of Preparation and Potential Toxicity

Fig. 3 illustrates the preferred preparation methods of medicinal plants among the surveyed population. The results clearly indicate that decoction is the dominant method, accounting for over 80% of reported practices. This prevalence reflects the perception that prolonged boiling not only enhances the extraction of active phytochemicals but also improves microbial safety by eliminating potential contaminants (Han *et al.* 2023; Tabouii *et al.* 2026). Infusion represents a smaller proportion ($\approx 15\%$) and is typically used for delicate plant parts, such as leaves and flowers, which may contain heat-sensitive compounds (Spréa *et al.* 2025). Powdered preparations were rarely reported (<5%), suggesting limited traditional reliance on this method, possibly due to preparation challenges, storage issues, or cultural preference for liquid remedies (Bencheikh *et al.* 2024).

These findings align with ethnobotanical research in other regions, where decoction remains the most frequently used preparation technique, particularly for gastrointestinal and infectious disorders (Giday *et al.* 2009; Benítez *et al.* 2012; Zerbo

et al. 2025). The predominance of decoction underscores the role of cultural heritage and empirical knowledge in shaping phytotherapeutic practices and highlights the importance of preparation methods in determining bioavailability, chemical stability, and therapeutic efficacy (Bencheikh *et al.* 2024).

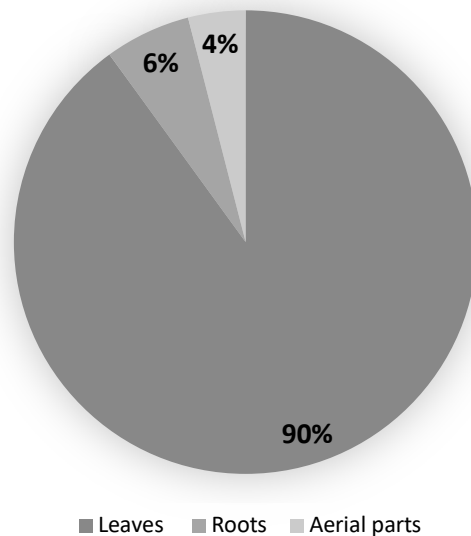


Figure 2.:Used part of the medicinal plant

Among the most frequently cited species, *M. communis* (RFC = 0.52; UV = 0.68) is predominantly prepared as a decoction, reflecting both its pharmacological potential and cultural significance. Decoction of *M. communis* leaves and berries has been shown to maximize the extraction of polyphenols, flavonoids, and tannins, which are associated with antimicrobial, antioxidant, and gastrointestinal protective activities (Medda *et al.* 2021; Al-Snafi 2024). Similarly, *P. lentiscus* (RFC = 0.35; UV = 0.42) is also mostly prepared as a decoction, facilitating solubilization of resinous and polyphenolic constituents, thereby enhancing its antiseptic, anti-inflammatory, and digestive health effects (Papada *et al.* 2019; Albrahim & Azzazy 2025).

Potential Side Effects and Toxicity: Although the surveyed population did not report adverse effects, it is important to acknowledge that traditional preparations can carry risks of toxicity, especially at high doses or with prolonged use (Tadesse *et al.* 2022; Eryugur & Coşkun 2025). Certain polyphenols, alkaloids, and other secondary metabolites may induce gastrointestinal irritation or interact with medications (Chaachouay 2025). Therefore, while decoction generally enhances safety by inactivating microbial contaminants, caution is warranted when preparing and consuming high-concentration decoctions, and phytochemical, toxicological, and dosage studies remain essential for the most frequently used species (Bencheikh *et al.* 2024). This consideration is particularly relevant for high-consensus taxa such as *M. communis* and *P. lentiscus*, where traditional knowledge should be supplemented by scientific evaluation to ensure both efficacy and safety (Nanisfi *et al.* 2025).

Taken together, the dominance of decoction as the main preparation method is not only consistent with broader ethnobotanical patterns but also directly relevant to the phytochemical properties and therapeutic potential of the most cited species. This underscores the co-evolution of cultural practices with empirical recognition of plant chemistry, ensuring maximum benefit and relative safety in traditional remedies.

Fig. 3 illustrates the preferred preparation methods of medicinal plants among the surveyed population. The results clearly indicate that decoction is the dominant method, accounting for more than 80% of reported practices. This prevalence reflects the perception that prolonged boiling enhances the extraction of active phytochemicals and ensures the safety of the preparation by eliminating potential microbial contaminants. Infusion, on the other hand, represents a much smaller proportion ($\approx 15\%$), and is often reserved for more delicate plant parts such as leaves and flowers, where heat-sensitive compounds may be degraded by boiling. Powdered preparations were rarely reported ($< 5\%$), suggesting limited traditional reliance on this method, possibly due to challenges in preparation, preservation, or cultural preference for liquid remedies.

These findings are consistent with ethnobotanical studies in other regions, where decoction remains the most frequently used preparation technique, particularly for treating gastrointestinal disorders and infectious diseases (Giday *et al.* 2009; Benítez *et al.* 2012). The dominance of decoction underscores the role of cultural heritage and empirical knowledge in shaping phytotherapeutic practices, while also highlighting the importance of preparation methods in determining the bioavailability, stability, and therapeutic efficacy of plant-based remedies.

Among the species reported, *Myrtus communis* emerged as the most frequently cited plant (RFC = 0.52; UV = 0.68), and its dominant use in decoction form reflects both its pharmacological potential and cultural significance. Previous studies have demonstrated that decoction of *M. communis* leaves and berries maximizes the extraction of polyphenols, flavonoids, and tannins, which are known for their antimicrobial and antioxidant activities (Medda *et al.* 2021; Al-Snafi *et al.* 2024). This may explain the preference for boiling as a preparation method, since it enhances the release of bioactive compounds that contribute to the plant's traditional use in treating gastrointestinal and respiratory disorders.

Similarly, *Pistacia lentiscus* (RFC = 0.35; UV = 0.42) is also predominantly prepared as a decoction in traditional practices. Decoction facilitates the solubilization of its resinous and polyphenolic constituents, thereby enhancing its therapeutic potential as an antiseptic, antimicrobial, and anti-inflammatory agent (Papada *et al.* 2019; Albrahim & Azzazy 2025). In addition, the use of boiling ensures the stability of its essential oils and terpenoids, which are crucial for its effectiveness in treating digestive and infectious diseases.

Taken together, the prevalence of decoction as the main preparation method is not only consistent with broader ethnobotanical patterns but also directly relevant to the most cited species, *M. communis* and *P. lentiscus*. This highlights how cultural practices of preparation may have co-evolved with empirical recognition of the plants' chemical properties, ensuring maximum therapeutic benefit and safety of traditional remedies.

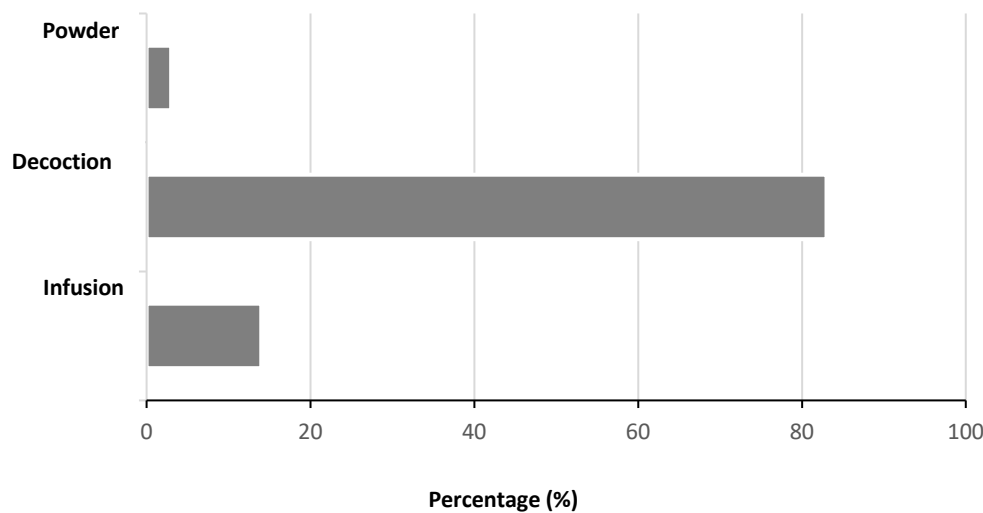


Figure 3. Preparation methods of medicinal plants

Sources of information

Personal experience constitutes the main source of information, representing approximately 45% of responses. It is followed by the Internet (30%) and reading (books, journals, written documentation) at 25% (Figure 4). The predominance of personal experience highlights the central role of empirical knowledge and individual practice in acquiring and preserving information on medicinal plants. This pattern is consistent with ethnobotanical surveys managed in Tunisia and across the Maghreb, where knowledge is predominantly transmitted orally and intergenerationally within families and local communities (Ben Salah *et al.* 2019; Karous *et al.* 2021).

Nevertheless, the emergence of the Internet as the second most frequently cited source (30%) reflects a shift in contemporary practices. Younger generations increasingly turn to digital platforms (forums, social media, blogs, online databases) to complement or verify traditional uses. While this transition facilitates broader and faster dissemination of information, it also raises concerns regarding the scientific reliability of such sources.

Reading (25%) also remains an important channel, particularly for more educated users with access to specialized phytotherapy books, herbals, and scientific publications. This pathway serves as a bridge between traditional knowledge and evidence-based research, thereby playing a crucial role in consolidating and preserving ethnobotanical heritage.

Comparable findings have been reported in Tunisia, Morocco, and Algeria, where family and community experience continues to dominate but is progressively complemented by modern sources (books, Internet, media). This hybridization illustrates an ongoing transition from purely traditional oral transmission toward a mixed model of traditional and modern knowledge exchange (Bouasla & Bouasla 2017; Hayat *et al.* 2020).

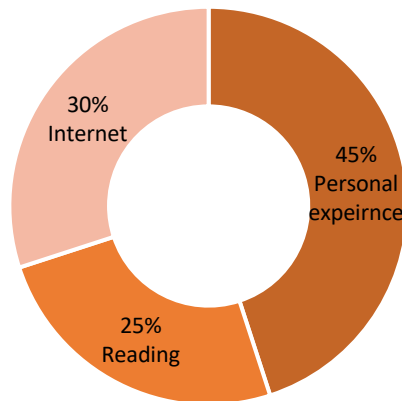


Figure 4. Main Sources of Knowledge Acquisition

Conclusion

This study demonstrates that medicinal plants remain a vital component of gastroenteritis management in El Hamra, Amdoun, Tunisia area. *M. communis* and *P. lentiscus* are the most widely used species, with leaves and decoction being the preferred part and method, respectively. Ethnobotanical knowledge is transmitted through both empirical experience and modern information sources, reflecting the coexistence of traditional and contemporary practices. These findings provide a baseline for pharmacological studies and the development of standardized herbal remedies, while emphasizing the need to preserve ethnobotanical knowledge across generations.

Declarations

List of abbreviations: RFC- Rate Frequency of Citation; UV-Use Value

Ethics approval and consent to participate: Not applicable

Consent for publication: Not applicable

Availability of data and materials: Not applicable

Competing interests: Not applicable

Funding: Not applicable

Author contributions: S.H. collected the data, analyzed, and write the text. C.H- J.B.S-C.J.-A.K-C.A. participated in the theoretical background, monitoring data collection and analysis, helping with discussions, and write the final version of the text.

Acknowledgements

The authors acknowledge the support provided by Tunisian Ministry of Higher Education and Scientific Research (LR16IPT03).

Literature cited

Adeyemi OO, Alabi AS, Adeyemi OA, Talabi OT, Abidakun OM, Joel IY, Stonehouse NJ. 2021. Acute gastroenteritis and the usage pattern of antibiotics and traditional herbal medications for its management in a Nigerian community. PLoS One 16:e0257837.

- Alabrahim OAA, Azzazy HME. 2025. Enhancing the therapeutic potential of *Pistacia* extracts: a review of nanocarrier-based strategies. *Phytochemistry Reviews* 1-37.
- Al-Snafi AE, Teibo JO, Shaheen HM, Akinfe OA, Teibo TKA, Emieseimokumo N, Batiha GES. 2024. The therapeutic value of *Myrtus communis* L.: an updated review. *Naunyn-Schmiedeberg's Archives of Pharmacology* 397:4579-4600.
- Ben Salah M, Barhouni T, Abderrabba M. 2019. Ethnobotanical study of medicinal plants in Djerba island, Tunisia. *Arabian Journal of Medicinal and Aromatic Plants* 5:164-187.
- Bencheikh N, Elbouzidi A, Baraich A, Bouhrim M, Azeroual A, Addi M, Elachouri M. 2024. Ethnobotanical survey and scientific validation of liver-healing plants in northeastern Morocco. *Frontiers in Pharmacology* 15:1414190.
- Bendada M, Hadini A, El Asri O, Taarabt Y, Nazih A, Andich K, Chaabane K. 2024. Evaluation of Phytochemical Content and *In vitro* antioxidant activities of *Pistacia lentiscus* L. leaves extracts, a medicinal plant from the Beni-Snassen Forest (Eastern Region of Morocco). *Scientifica* 2024: 9999175.
- Benítez G, González-Tejero MR, Molero-Mesa J. 2012. Knowledge of ethnoveterinary medicine in the province of Granada, Andalusia, Spain. *Journal of Ethnopharmacology* 139: 429-439.
- Bouasla A, Bouasla I. 2017. Ethnobotanical survey of medicinal plants in northeastern of Algeria. *Phytomedicine* 36:68-81.
- Chaachouay N. 2025. Synergy, additive effects, and antagonism of drugs with plant bioactive compounds. *Drugs and Drug Candidates* 4:4.
- Chermat S, Gharzouli R. 2015. Ethnobotanical study of medicinal flora in the North East of Algeria-An empirical knowledge in Djebel Zdimm (Setif). *Journal of Materials Science and Engineering* 5:50-59.
- De Oliveira JR, Camargo SEA, De Oliveira LD. 2019. *Rosmarinus officinalis* L.(rosemary) as therapeutic and prophylactic agent. *Journal of Biomedical Science* 26:5.
- Dean M. 2024. Exploring ethnobotanical knowledge: Qualitative insights into the therapeutic potential of medicinal plants. *Golden Ratio of Data in Summary* 4:154-166.
- Eryugur N, Coşkun 2025. Medicinal and aromatic plants that are toxic. *Medicinal and Aromatic Plants: Pharmaceutical, Food, and Cosmetic Applications*, 155.
- Gamoun M, Louhaichi M. 2024. Roles of Lamiaceae plants from the arid and desert rangelands of Tunisia in human health and therapy. *All Life* 17:2381675.
- Giday M, Asfaw Z, Woldu Z. 2009. Medicinal plants of the Meinit ethnic group of Ethiopia: An ethnobotanical study. *Journal of Ethnopharmacology* 124:513-521.
- Hamrouni H, Idoudi S, Romdhane M, Elfalleh W. 2023. Ethnobotanical study of medicinal plants used in southern Tunisia. *Euro-Mediterranean Journal for Environmental Integration* 8: 807-821.
- Han S, Zhang H, Wang, Y. 2023. Investigation of Chinese Herbal Decoctions with Enzymatic Hydrolysis and Sequential Fermentation as Potential Nutrient Supplements. *Applied Sciences* 13: 2154.
- Hayat J, Mustapha A, Abdelmajid M, Mourad B, Ali S, Said E, Saadia B. 2020. Ethnobotanical survey of medicinal plants growing in the region of "Oulad Daoud Zkhanine" (Nador Province), in Northeastern Morocco. *Ethnobotany Research and Applications* 19:1-12.
- Hennia A, Nemmiche S, Dandlen S, Miguel MG. 2019. *Myrtus communis* essential oils: insecticidal, antioxidant and antimicrobial activities: a review. *Journal of Essential Oil Research* 31:487-545.
- Huet M, Odonne G, Baghdikian B, Teixidor-Toneu I. 2024. Knowledge and Access to Medicinal and Aromatic Plants by Women from the Maghrebi Diaspora in Marseille. *Human Ecology* 52: 891-904.
- Karous O, Ben Haj Jilani I, Ghrabi-Gammar Z. 2021. Ethnobotanical study on plant used by semi-nomad descendants' community in Ouled Dabbeb Southern Tunisia. *Plants* 10 :642.
- Lyoussi B, Bakour M, Cherkaoui-Tangi K, El-Hilaly J, Hano C. 2023. Ethnobotanical survey and pharmacological screening of medicinal plants used as antihypertensive in Sefrou province (middle-north of Morocco): Benefits and challenges. *Frontiers in Bioscience-Scholar* 15: 4.
- Mansour RB, Beji RS, Wasli H, Zekri S, Ksouri R, Megdiche-Ksouri W, Cardoso SM. 2022. Gastroprotective effect of microencapsulated *Myrtus communis* essential oil against ethanol/HCl-induced acute gastric lesions. *Molecules* 27 :1566.
- Medda S, Fadda A, Dessena L, Mulas M. 2021. Quantification of total phenols, tannins, anthocyanins content in *Myrtus communis* L. and antioxidant activity evaluation in function of plant development stages and altitude of origin site. *Agronomy* 11:1059.

- Mekonnen AB, Mohammed AS, Tefera AK. 2022. Ethnobotanical study of traditional medicinal plants used to treat human and animal diseases in Sedie Muja District, South Gondar, Ethiopia. Evidence-Based Complementary and Alternative Medicine 2022:7328613.
- Milia E, Bullitta SM, Mastandrea G, Szotáková B, Schoubben A, Langhansová L, Eick S. 2021. Leaves and fruits preparations of *Pistacia lentiscus* L.: a review on the ethnopharmacological uses and implications in inflammation and infection. Antibiotics 10 :425.
- Nanisfi M, Susilawati S, Gunawan G, Santoso D, Japa, L. 2025. Trend of Traditional Medicine and Ethnobotany Research: A Bibliometrics Analysis. Current Educational Review 1: 1-10.
- Papada E, Kaliora AC. 2019. Antioxidant and anti-inflammatory properties of mastiha: A review of preclinical and clinical studies. Antioxidants 8:208.
- Spréa RM, Caleja C, Pereira E, Carocho M, Pinela J, Finimundy TC, Barros L. 2025. Effect of Heat-Assisted and Ultrasound-Assisted Extraction Methods on the Phenolic Profile and Biological Activity of *Thymus vulgaris* L. Extracts. Antioxidants 14: 567.
- Tadesse TY, Zeleke MM, Dagne SB. 2022. Review of ethnobotanical and ethnopharmacological evidence of some Ethiopian medicinal plants traditionally used for peptic ulcer disease treatment. Clinical and Experimental Gastroenterology 15: 171-187.
- Tabouii M, Mahmoudi H, Aouadhi C. 2026. Ethnobotanical survey of *Artemisia vulgaris* and *Laurus nobilis* in the treatment of microbial gastroenteritis in Northwestern Tunisia. Ethnobotany Research and Applications 33: 1-10.
- Yemmen M, Landolsi A, Hamida JB, Mégraud F, Ayadi MT. 2017. Antioxidant activities, anticancer activity and polyphenolics profile, of leaf, fruit and stem extracts of *Pistacia lentiscus* from Tunisia. Cellular and Molecular Biology 63:87-95.
- Youssef EA, El-Mehdi EA, Mahraz MA, Amine MI, Fatima M, Mouna EK, Amal L. 2025. Ethnobotanical and Ethnopharmacological Studies of Medicinal Plants in the Southern Mediterranean: Tangier-Tétouan Region, Northern Morocco. Tropical Journal of Natural Product Research 9:1039 - 1057.
- Zerbo I, Balima LH, Sanou CL, Thiombiano A. 2025. Diversity of plants used in traditional veterinary medicine in Central-Eastern Burkina Faso: Plants used in Traditional Veterinary Medicine. Ethnobotany Research and Applications 30: 1-30.