Ethnobotany of *Lavandula × intermedia* 'Abrialis' in the Commune of Oulmès, Morocco

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Research

Abstract

Background: The preservation of traditional knowledge about plant species is essential for their conservation and valorization. *Lavandula × intermedia* 'Abrialis', a species widely cultivated in the Oulmès region of Morocco, is traditionally used for its medicinal properties. This study explores the local ethnobotanical knowledge associated with this plant in Oulmès, a region known for its longstanding use of lavender in traditional medicine.

Methods: An ethnobotanical survey was conducted from March to June 2024 with 105 participants of diverse ages, genders, education levels, and socio-economic backgrounds. Data were collected using semi-structured questionnaires and analyzed using descriptive indicators such as Relative Frequency of Citation (RFC), Fidelity Level (FL), chi-square tests, and Multiple Correspondence Analysis (MCA).

Results: The findings indicate that broncho-pulmonary ailments are the most commonly treated conditions, with the highest RFC (0.87) and FL (83.81%). Four primary usage categories emerged: medicinal (85.71%), cosmetic (66.67%), commercial (45.71%), and ecological (24.76%). Chi-square analysis showed no significant link between age and knowledge source, but significant associations were found with gender, socio-economic status, and education, emphasizing their roles in knowledge transmission.

Conclusion: This study underscores the medicinal importance of *L. × intermedia* 'Abrialis' in Oulmès and the value of preserving traditional plant knowledge. It also provides a foundation for future pharmacological research and supports the sustainable management of this species.

Keywords: Medicinal plants, *Lavandula × intermedia* 'Abrialis', Ethnobotanical study, Socio-economic, Traditional use, Oulmès, Morocco.

Background

Despite the significant progress made in modern medicine and the growing access to contemporary therapies, interest in traditional pharmacopoeia remains significant (Abouri *et al*.2012). Medicinal and aromatic plants represent an invaluable medical heritage for human health, particularly in developing countries, where they play a crucial role in primary healthcare and the livelihood of populations, often in the absence of modern medical infrastructure (EL Moussaoui *et al.*2021).

Traditional medicine in Africa is an ancient and diverse system, recognized as one of the most widespread in the world (Ikhoyameh *et al.*2024). According to the World Health Organization (WHO), nearly 80% of the African population relies on traditional medicine for their primary healthcare needs (Tuasha *et al.*2023).

Morocco is a true phytogenetic reservoir, with approximately 4,200 species, of which nearly 400 are known for their medicinal and aromatic uses (Fakchich & Elachouri 2021, Bellakhdar 1991). This richness allows it to occupy a privileged position among Mediterranean countries, which have a long medical tradition and expertise based on medicinal plants (Scherrer *et al*.2005, Bellakhdar *et al.*1997). These traditional medical knowledge systems are passed down orally from generation to generation (Aboukhalaf *et al*.2022; El-Hilaly *et al*.2003). Therefore, conducting ethnobotanical studies is essential for documenting this knowledge before it disappears. Such research not only helps identify, preserve, and perpetuate this knowledge but also promotes its transmission and exchange.

One of the most well-known species in Morocco is *Lavandula × intermedia* 'Abrialis', which belongs to the Lavandula genus and the Lamiaceae family (Radi et *al.*2024). This lavender is found in the Saïss plain as well as in the mountains of the Middle Atlas and the High Atlas. This subshrub can reach a height of one meter with blue-violet flowers. It is widely used in herbal medicine and aromatherapy for its medicinal properties. However, scientific research on this species conducted in laboratories in Morocco remains limited (Radi *et al*. 2022). Moreover, no specific ethnobotanical study has been conducted on this plant, resulting in a lack of reliable information, which is a major obstacle to its conservation and sustainability. Although this study is geographically limited, it will help fill the gaps in local knowledge and support the implementation of management and conservation strategies for this resource.

The study was conducted in the commune of Oulmès, located in the Middle Atlas Mountains, within the Khemisset province. Due to its bioclimatic conditions and geographical position, this region is distinguished by a high abundance and wide distribution of Lavandula × intermedia 'Abrialis', thus constituting an important source of income for local populations.

The objective of this research was to document local knowledge related to this plant, evaluate traditional knowledge based on sociodemographic factors such as sex, age, socioeconomic status, and education level, identify areas of use, characterize the parts of the plant exploited, and understand its therapeutic uses.

Materials and Methods

Presentation of the study area

The commune of Oulmès (Figure 1) is part of the Khémisset province (Rabat-Salé-Kénitra Region) and covers an area of 1001.66 km² This area is dominated by rugged terrain, which represents more than 80% of the total surface area (DPA 2022).

The climate is subhumid, characterized by wet and cold winter and a hot summer. Monthly rainfall follows a variable pattern from year to year, reflecting the irregularity of precipitation (annual averages range between 280 mm and 400 mm). Snowfall can occur from mid-November, with temperatures ranging from -2°C to 40°C (DPA 2022). This climate allows the region to be rich in aromatic and medicinal plants and also contributes to the development of various lavender varieties, particularly *Lavandula × intermedia* 'Abrialis'.

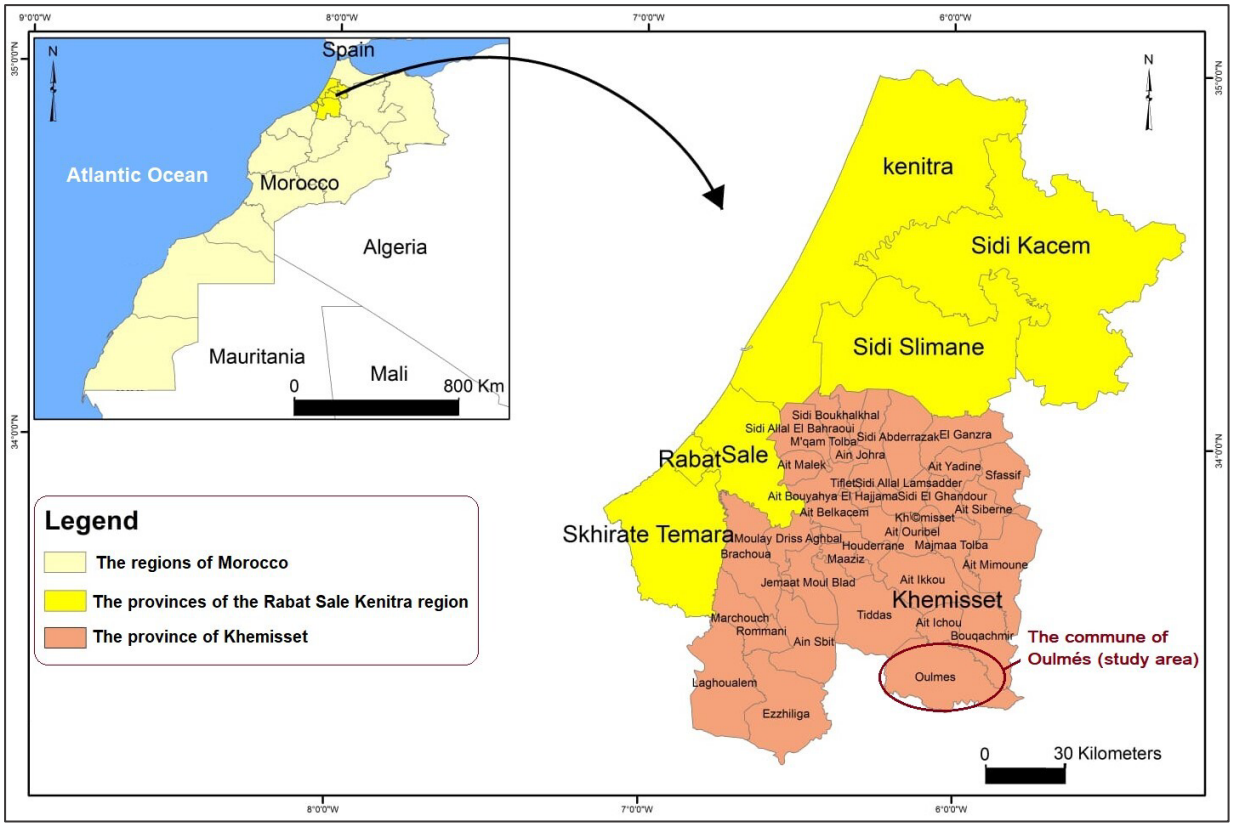

Figure 1.Geographic location of the Oulmès study area

Data collection and plant identification.

Ethnobotanical data were collected through questionnaires from the local population in the study area, with informed consent after being briefed on the research objectives. The survey was conducted between March and June 2024. A random sample of 105 respondents was selected based on their specific knowledge of *Lavandula × intermedia* 'Abrialis'. The interviews took place as open discussions in Arabic, allowing for free responses, either individually or in groups. The duration of the interviews ranged from 30 minutes to one hour, depending on the availability of the participants. The questionnaire was structured into two parts: the first focused on the informants sociodemographic information (gender, age, education level, socioeconomic status), and the second gathered ethnobotanical data (vernacular name, uses of the plant, medicinal properties, parts used, etc.). Botanical identification of the studied species was carried out at the Scientific Institute of Rabat, Department of Botany.

Data Analysis

The collected data were subjected to descriptive statistical analysis using Microsoft Excel 2019 and SPSS version 26 software. Multiple Correspondence Analysis (MCA) was performed to examine the relationship between sociodemographic characteristics and documented knowledge sources. Furthermore, a Pearson's chi-square test was conducted to assess the strength of the correlation between sociodemographic variables and the knowledge source of the plant under study. Additionally, the data were analyzed using various quantitative ethnobotanical indices, such as the Relative Frequency of Citation (RFC) and the fidelity level (FL), which provided a deeper understanding of the relationships between the plant under study and its use by the local population.

Relative Frequency of Citation

The RFC (Relative Frequency of Citation) shows the relative importance of the species in the study area. It is determined by dividing the number of informants who mention the use of the species, corresponding to the frequency of citations (FC), by the total number of individuals surveyed (N). It was calculated using the following formula (Kayani *et al*.2015):

$$\mathbf{RFC} = \frac{\mathbf{FC}}{\mathbf{N}} \qquad \mathbf{(1)}$$

RFC values range from 0 to 1.

Fidelity Level

The Fidelity Level (FL) measures the proportion of informants who cite a plant for a particular use. It corresponds to the use of the plant to treat the disease categories mentioned by the interviewees. This is a key indicator for evaluating the effectiveness of a species in treating specific diseases (Ahmad et al. 2018), and it is calculated using the following formula (Mechaala et al. 2022):

$$\mathbf{FL} = \frac{\mathbf{Np}}{\mathbf{N}} \times \mathbf{100} \quad \mathbf{(2)}$$

where Np is the number of respondents who mentioned the use of lavender for a specific disease category, and N is the number of respondents who cited the use of this species for any disease category.

Results and Discussion

Socio-demographic characteristics of respondents

Several field visits were organized throughout 2024 to collect and document the most comprehensive ethnobotanical data . Table 1 presents the sociodemographic characteristics of each respondent. In total, 105 local informants were surveyed in the commune of Oulmès. Regarding the profile of the respondents, the majority were in the age group [35-50 years] (46.67%), followed by the [50-60 years] group (27.62%), while respondents aged [20-35 years] represented only 14.29%. People over 60 years of age were the least represented (11.42%). Women (57.14%) and men (42.86%) shared knowledge of medicine.

These results are similar to those reported by Hedidi *et al*. (2020), who demonstrated that the use of medicinal plants, is a common practice among both sexes. Most of the participants were uneducated (42.85%), followed by those with primary (25.72%) and secondary (21.91%) education. The respondents with a higher degree of education were the least numerous (9.52%). Finally, regarding socio-economic level, a large proportion of participants belonged to a low socio-economic level (56.19%), compared to 44.91% with a middle level, and only 1.9% with a high socio-economic level.

Table 1. Socio-demographic characteristics of respondents

	Categories	Number	Percentage (%)
Gender	Female	45	42,86
	Male	62	57,14
Age	20-35	15	14,29
	35-50	49	46,67
	50-60	29	27,62
	>60	12	11,42
Education Level	Illiterate	45	42,85
	Primary	27	25,72
	Secondary	23	21,91
	Higher education	10	9,52
Socioeconomic level	Low	59	56,19
	Middle	44	41,91
	High	2	1,9

Sources of knowledge on the plant

Botanical identification of the collected samples of the studied species (Figure 2) was carried out at the Scientific Institute of Rabat, Department of Botany, and registered under herbarium number RAB114629.

The species *Lavandula × intermedia* 'Abrialis', locally referred to as "Al Khouzama," is widely recognized by the local population, in accordance with previous ethnobotanical research conducted in Morocco (Bachiri *et al.* 2016, El Hachlafi *et al.* 2020). Indeed, all interviewees were familiar with this plant, reflecting its cultural, economic, and environmental importance in the region.

Sources of knowledge regarding the use of lavender vary significantly. Most respondents (69.5%) relied on knowledge passed down through generations, highlighting the importance of cultural heritage in preserving traditional practices. In contrast, 20.95% of respondents based their knowledge on the recommendations of herbalists, reflecting a more modern and

professional approach to acquiring information about medicinal plants. Finally, a smaller proportion (9.55%) indicated that their information comes from consulting scientific literature, as well as media such as television, radio, the Internet, and other channels, serving as complementary sources of information on plants.

Figure 2.Photos of *Lavandula × intermedia* 'Abrialis' (RADI Mohamed and ZAIR Touriya 2024)

Correlation between sociodemographic variables and knowledge of Lavandin

The analysis of the data using the chi-square test showed that there was no significant correlation between the participants' age and their source of knowledge about *Lavandula × intermedia* 'Abrialis', suggesting that age does not influence how individuals acquire their knowledge about this plant. However, significant relationships were observed between the source of knowledge and other sociodemographic variables, such as gender, education level, and socio-economic status, with a p-value less than 0.05 and a strong correlation (Table 2). These results suggest that gender, education, and socio-economic status significantly influence sources of knowledge.

Thus, a majority of men (74.15%) report that their primary source of knowledge comes from intergenerational transmission, while 37.53% of women are more likely to refer to herbalists for information on the use and properties of *Lavandula × intermedia* 'Abrialis'. Additionally, individuals from socio-economically disadvantaged backgrounds (76.19%) prioritized oral transmission of knowledge, whereas 61% of people with university education cited media, specialized books, and scientific publications as their main sources of information.

Table 2. Statistical analysis results: Chi-square test

Socio-demographic variables	**Source of knowledge**		
	Chi-square	**P-Value**	**Phi/ v cramer**
Gender	9.528	0.006	0.403
Age	5.172	0.682	---
Education level	12.638	0.000	0.518
Socioeconomic level	6. 935	0.029	0.376

Sociodemographic Characteristics and Knowledge Sources: Multiple Correspondence Analysis (MCA)

Multiple correspondence analysis (MCA) is a multidimensional exploratory method that creates a synthetic representation of categories derived from various qualitative survey criteria. In our analysis, the graphical representation generated by MCA highlighted the relationships between sociodemographic variables and different sources of knowledge related to the plant.

The results indicated a significant association between informants and sources of knowledge. Thus, individuals with higher or university-level education primarily favor documentary and media sources, such as specialized books, the Internet, media, and scientific publications, emphasizing the importance of access to formal information for acquiring knowledge. Furthermore, the knowledge *Lavandula × intermedia* 'Abrialis' among adult women is strongly associated with recommendations from herbalists, reflecting the trust placed in these practitioners, as shown in Figure 3.

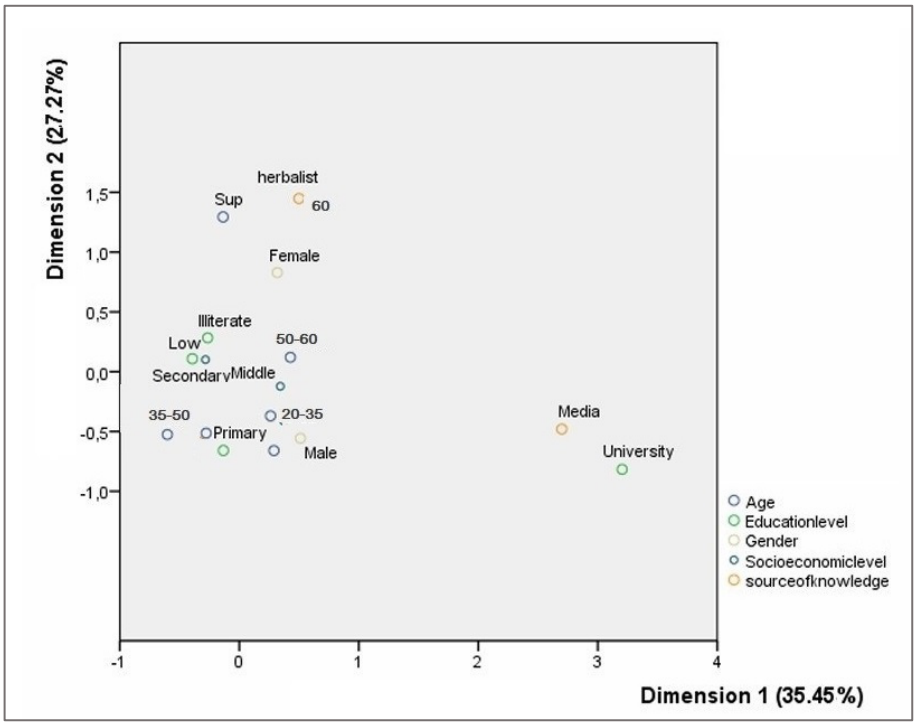

Figure 3. Graphical representation of the multiple correspondence analysis (MCA)

Uses of the plant

The responses collected allowed for the identification of several categories of lavender use, particularly in the fields of medicine and cosmetics, but also in sectors such as commerce and ecology (see Figure 4). Among these categories, medicinal use was the most predominant, with 85.71% of informants mentioning it. This was followed by cosmetic applications, cited by 66.67% of respondents, highlighting its importance in this field. Commercial applications occupied the third position, with 45.71% of responses. In contrast, ecological and environmental uses were the least mentioned, with only 24.76% of respondents referring to them. The results obtained are consistent with those of Bachiri *et al.*2016 and Bachiri *et al.* 2015 in Morocco, as well as with the studies of Xomidov 2023 in Uzbekistan, Eray-Bozyel and Merdamert-Bozyel 2020 in Turkey,and Pokajewicz *et al.* 2023 in Poland.

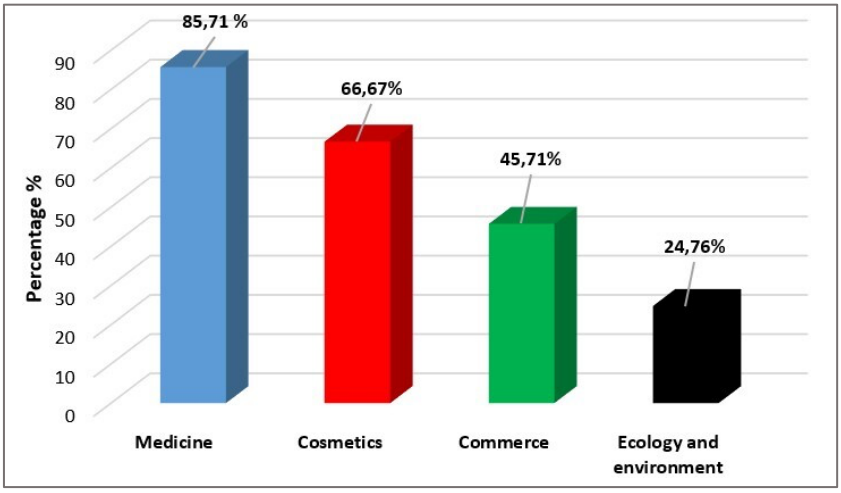

Figure 4.Uses of *Lavandula abrialis* according to the respondents

Cosmetic Use

The survey results revealed that 66.67% of participants use *Lavandula × intermedia* 'Abrialis' in cosmetic applications. This ingredient is a valuable asset in traditional cosmetics in the Oulmès region because of its numerous beneficial properties. Its essential oil, which is often combined with vegetable oils, is commonly used for skin hydration and perfumery. It is also used by the local population for massage and facial treatments. Additionally, it is combined with other plants, such as henna and

rosemary, for hair care. Finally, it is used in the form of scented sachets for clothing or burned as incense in local domestic hammams to purify air and promote relaxation.

Commercial Use

Our survey revealed that 45.71% of participants use *Lavandula × intermedia* 'Abrialis' to market its flowers and leaves. This activity occurs on a small scale, in local markets, and on a larger scale, within agricultural cooperatives and the industry. These results highlight the significant socio-economic importance of this plant in the studied region.

Ecology and Environment

From an ecological and environmental perspective, 24.76% of the survey participants reported using *Lavandula × intermedia* 'Abrialis' to attract pollinators, particularly bees. This practice offers several notable benefits, such as enhancing local biodiversity, contributing to honey production, and benefiting local beekeepers.

Medicinal Use

In this ethnobotanical study, we observed that 85.72% of the respondents use *Lavandula × intermedia* 'Abrialis' to treat or relieve a wide range of diseases, which are grouped into four categories: bronchopulmonary, gastrointestinal, urogenital, and rheumatic and dermatological conditions.

The RFC values for each disease category ranged from 0.28 to 0.87. The highest usage rates were reported for bronchopulmonary conditions (0.87), followed by gastrointestinal (0.58), urogenital (0.43), and rheumatic and dermatological conditions (0.28) (Table 3).

Data analysis revealed that the FL values for *Lavandula × intermedia* 'Abrialis' ranged between 25.71% and 83.81% (see Table 3). The results showed that this species has a particularly high Fidelity Index (83.81%) for treating respiratory conditions. These results are consistent with the findings of other studies on lavender conducted in Morocco, which identified categories of diseases similar to those observed in our study (Bachiri *et al.* 2015; Hachi *et al.* 2015; El Finou *et al.* 2023; El Yaagoubi *et al.* 2023), as well as with a study conducted by Xomidov 2023 in Uzbekistan.

Table 3. RFC and FL by Disease Category

Diseases treated	RFC	FL (%)
Bronchopulmonary conditions	0,87	83,81
Gastrointestinal conditions	0,58	51,42
Urogenital conditions	0,43	45,71
Rheumatic and dermatological conditions	0,28	25,71

Parts used for the treatment of diseases

The studied species has several aspects that can be exploited for therapeutic purposes. The results of our ethnobotanical survey showed that the main parts used were the leaves and flowers, either separately or in combination, depending on specific needs and local practices (see Figure 5). Thus, flowers were used in 53.34% of the cases, combined leaves and flowers in 38.09%, and leaves alone in 8.57%. These results are consistent with those of other studies on this genus, conducted in Morocco and Europe (Soulaimani *et al.*2024; Bachiri *et al*. 2015; Eray-Bozyel and Merdamert-Bozyel 2020; Tardugno *et al.* 2019).

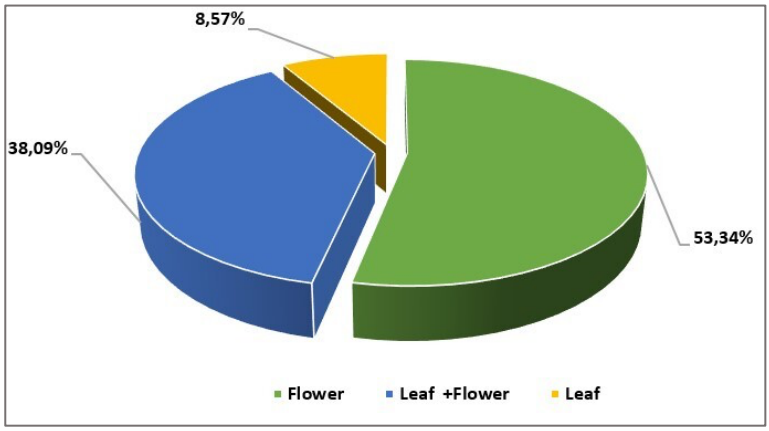

Figure 5.Parts used of the studied plant

Mode of preparation and application

The most common preparation method was the decoction (52.4%). Based on the habits of plant users in the region, this preparation method would help eliminate toxic substances, thus reducing the risk of poisoning. This was followed by infusion, maceration, and poultice, with frequencies of 24.76%, 14.28%, and 10%, respectively (Figure 6). These lavender preparation methods have also been reported by El Hilah *et al.* 2015, Eray-Bozyel and Merdamert-Bozyel (2020), Xomidov 2023, and Slimani *et al.* (2016).

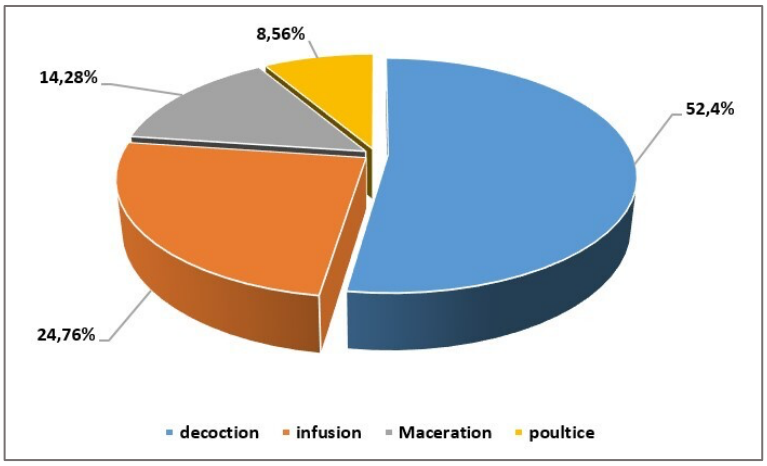

Figure 6.Modes of preparation used by informants

Conclusion

The ethnobotanical study conducted in the Oulmès region provided valuable information about the knowledge and use of *Lavandula × intermedia* 'Abrialis' by the local population. Our results showed that this plant is widely recognized and used to treat various conditions, such as bronchopulmonary, gastrointestinal, and urogenital disorders, as well as rheumatic and dermatological conditions. The main parts used were the leaves and flowers, either alone or in combination.

Furthermore, the study reveals a strong correlation between the knowledge of *Lavandula × intermedia* 'Abrialis' and various socio-economic factors, including living standards, education level, and gender.

In conclusion, this study highlights the traditional medicinal knowledge of the population of Oulmès and provides a valuable ethnobotanical database for researchers, in view of future phytochemical and pharmacological investigations.

Declarations

Ethics approval and Consent to participate: Before beginning the ethnobotanical study, verbal consent was obtained from all participants. The data were collected with respect to confidentiality, anonymity and consent of the respondents who were informed about the aim of this study before the interviews.

Consent for publication: Not applicable.

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

Competing interests: The authors state that they do not have any conflicting interests.

Author contributions: Conceptualization: MR; Methodology: MR, DA, AEL, ELN, ELOH, FZA,EB and ZKH; Experimentation. Formal analysis and investigation: MR, ELOM, DB, and AK; Writing - original draft preparation: MR; Writing - review and editing: AEI and TZ; Supervision: MR.

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