Ethnobotanical survey of medicinal plants used during pregnancy in Setif, Algeria: a study among herbalists

Soraya Madoui, Hanane Khither, Kamel Mokhnache, Rania Aggari, Selsabil Ali Hellal

Correspondence

Soraya Madoui*, Hanane Khither, Kamel Mokhnache, Rania Aggari, Selsabil Ali Hellal

Laboratory of Applied Biochemistry, University Ferhat ABBAS Setif, 19000, Algeria.

*Corresponding Author: madoui_soraya85@yahoo.fr / madoui.soraya@univ-setif.dz

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Research

Abstract

Background: Pregnancy is a highly sensitive period during which women often avoid synthetic drugs and turn to traditional medicinal plants. This study aimed to identify medicinal plants used during pregnancy in Setif, Algeria, through an ethnobotanical survey of herbalists.

Methods: A cross-sectional survey was conducted over four months (January-April 2024). A paper-based questionnaire in Arabic was administered to 30 herbalists in Setif. Data were analysed using SPSS.

Results: Among herbalists, 80.0% recommended fennel, 86.7% used plant mixtures, and 63.3% preferred hot water infusion. The most accepted plants were fennel (83.3% agreement), chamomile (80.0%), and lemon verbena (76.6%). Plants with high uncertainty included cinnamon (73.3% no comment), rue (76.7% no comment), and wormwood (66.7% no comment). All herbalists (100%) agreed that dosage affects maternal and foetal health, and 76.7% advised against plant use in the first trimester.

Conclusion: Medicinal plant use during pregnancy is common in Setif, reflecting cultural practices. However, significant uncertainty exists regarding several plants. Better education and evidence-based guidelines for herbalists are needed to ensure maternal and foetal safety.

Keywords: Medicinal plants, fennel, chamomile, cinnamon, herbalists, pregnancy, ethnobotany.

Background

The female body undergoes profound changes during pregnancy, affecting all organ systems. These physiological adaptations support foetal development but often lead to discomforts such as nausea, vomiting, insomnia, stress, anxiety, and sometimes more serious conditions like gestational diabetes and anaemia (Soma-Pillay *et al*. 2016, Gangakhedkar & Kulkarni 2021). In Algeria, as in many countries, pregnant women frequently experience these symptoms and seek relief through various means.

In response, pregnant women worldwide increasingly turn to herbal medicines, driven by the perception that natural remedies are safer than conventional drugs (Al-Tawalbeh *et al*. 2024). This trend is particularly pronounced in Algeria, where traditional medicine is deeply rooted in local culture, and herbalists (known locally as *attar* or *herboriste*) are widely

consulted for a variety of health issues, including those related to pregnancy. Herbalists play a key role in communities, often serving as the first point of contact for women seeking advice on natural remedies (Sarecka-Hujar & Szulc-Musioł 2022). Several medicinal plants have gained popularity due to their perceived benefits during pregnancy. For example, ginger is widely used to reduce nausea and vomiting, while fennel is believed to aid digestion and relieve colic. Chamomile and lemon verbena are commonly used for their calming effects on anxiety and insomnia. However, not all herbs are safe (Sarecka-Hujar & Szulc-Musioł 2022). Some may pose significant risks to maternal health or foetal development. For instance, cinnamon may induce uterine contractions or affect blood sugar levels, rue (*Ruta graveolens*) is a known abortifacient, and wormwood (*Artemisia absinthium*) contains thujone, which can be neurotoxic (Balarastaghi *et al*. 2022). Moreover, the safety of many plants during pregnancy has not been adequately studied, and dosage, preparation method, and trimester of use are critical factors that can transform a beneficial remedy into a harmful one (Tesfaw *et al*. 2021).

Despite the widespread use of medicinal plants during pregnancy in Algeria, there is a lack of scientific documentation regarding which plants are actually recommended by herbalists, how they are prepared, and what precautions are advised. This knowledge gap is problematic because it prevents the development of evidence-based guidelines and leaves pregnant women vulnerable to potential harm. Therefore, this study aimed to: (1) identify medicinal plants used during pregnancy in Sétif, Algeria, as reported by herbalists; (2) evaluate herbalists' perceptions of the benefits and risks of these plants; (3) document preparation methods, dosage considerations, and trimester-specific recommendations; and (4) identify areas of uncertainty or caution among herbalists to target future educational interventions.

Materials and Methods

Study area

Ethnobotanical data were collected in Sétif province, northeastern Algeria, one of the largest provinces in the country, with a population of approximately 1.5 million inhabitants. The region comprises 60 municipalities (communes) and numerous villages distributed across its territory (Fig. 1). The region is characterized by a strong tradition of herbal medicine and a high density of herbal shops (herboristeries) located throughout the city and its surroundings.

The study area map was produced using QGIS version 3.36.2. Administrative boundary data were obtained from the GADM 2024 database. All spatial datasets were processed and validated to ensure mapping accuracy.

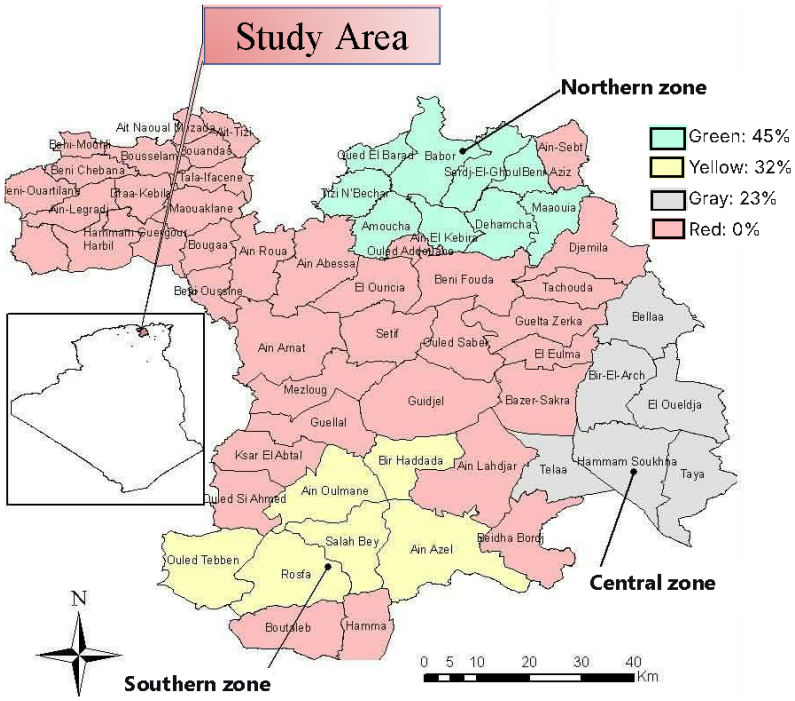

Figure 1. Setif (Algeria): study area and proportions of questionnaire responses by sector.

Data Collection Instrument

Data were collected using a structured questionnaire administered to herbalists selected for their expertise in the traditional use of medicinal plants during pregnancy. The questionnaire was designed to document both respondent characteristics and

traditional therapeutic practices. It was conducted over a four-month period (January to April 2024) and was administered exclusively in paper format. The instrument was divided into three main sections:

Personal Information

This section addresses the following questions:

- Herbal Medicine During Pregnancy: Consensus and Risks Among Herbalists
- Consultations of Pregnant Women with Herbalists Regarding Medicinal Plants.
- Perception of Medicinal Plants as an Alternative to Pharmaceutical Drugs.
- Perception of Risks Associated with Medicinal Plants.

Medicinal Plants Section

This section provides an overview of the following aspects:

- Classification of plants: beneficial and potentially harmful species.
- Most effective preparation methods based on the plant part used (seeds, leaves, roots, etc.): infusion, decoction, cold maceration, steam inhalation, etc.
- Preparation of herbal remedies: using a single plant or a combination of several plants.

Effects of Medicinal Plants Section

This section focuses on the following aspects:

- The impact of dosage on the effectiveness and safety of medicinal plants.
- Use of medicinal plants during different stages of pregnancy.
- Reasons why women turn to herbal remedies (cultural beliefs, accessibility, personal preference, etc.).
- Practical tips and guidance for the safe and effective use of medicinal plants.

Data Analysis

The information collected through this questionnaire was systematically compiled and organized into a database using Excel 2016. Several tables were created to effectively structure the collected data. The dataset was then processed and analysed using SPSS software, allowing for the generation of various graphs. This analytical process provided deeper insights into the medicinal plants used and their role in supporting pregnant women, as highlighted by the questionnaire responses.

Results

Personal information section

Herbal medicine during pregnancy: consensus and risks among herbalists

The questionnaire notably aimed to explore herbalists' perceptions regarding the effects of medicinal plants on the health of pregnant women. The results, presented in figure 2, reveal a very clear trend: an overwhelming majority of herbal sellers, 96.7%, believe that plants have an effect on the health of pregnant women, while a very small proportion, 3.3%, think otherwise.

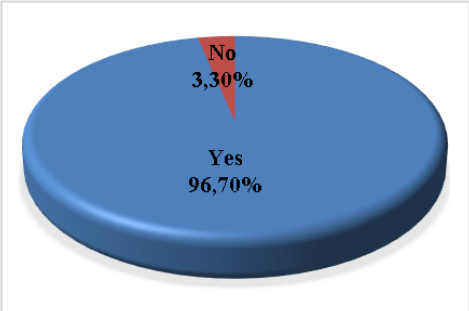

Figure 2. Herbal medicine during pregnancy: consensus and risks among herbalists.

Consultations of pregnant women with herbalists regarding medicinal plants

Understanding how pregnant women perceive and use medicinal plants is essential for promoting safe health practices during pregnancy. The following data sheds light on the inter-actions between pregnant women and herbal sellers, highlighting the level of awareness and inquiry regarding herbal remedies in this sensitive period. From figure 3, we observe that a large majority of herbal sellers (90%) reported that pregnant women inquire about the effects of medicinal plants, while only 10% indicated that women do not ask such questions.

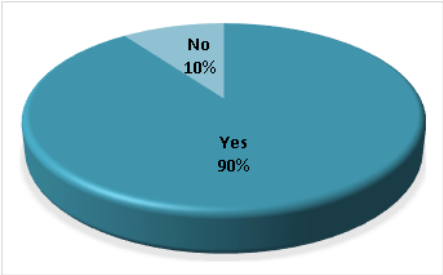

Figure 3. Consultations of pregnant women with herbalists regarding medicinal plants.

Perception of Medicinal Plants as an Alternative to Pharmaceutical

According to figure 4, 70% of medicinal plant sellers believe that these plants can serve as an alternative to pharmaceutical drugs for pregnant women. However, 30% remain cautious about this possibility.

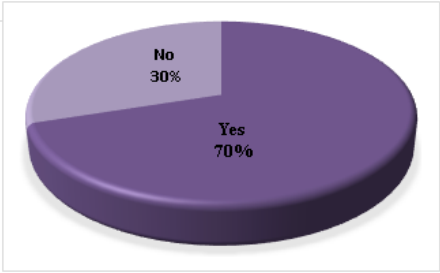

Figure 4. Perception of medicinal plants as an alternative to pharmaceutical drugs in pregnant women.

Perception of risks associated with medicinal plants

The questionnaire also aimed to assess herbalists' awareness of the potential side effects of medicinal plants, especially concerning pregnant women. According to the figure 5, a large majority of herbal sellers, 90%, acknowledge that some plants may have side effects. Only 10% believe otherwise.

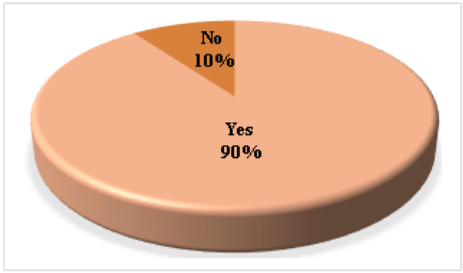

Figure 5. Perception of risks associated with medicinal plants, especially during pregnancy.

Medicinal plants section

Classification of plants: beneficial and potentially harmful species.

During pregnancy, many women use medicinal plants to treat common issues or to feel better. However, not all plants are completely safe, and herbalists may have different opinions about their use. This study presents what herbalists think about various plants used during pregnancy. It helps us understand which plants are generally accepted, which are questioned, and where more knowledge is needed to better guide pregnant women.

Medicinal Plants Identified

Plant identification was carried out through direct morphological examination of fresh and dried specimens provided by the participating herbalists. All samples were examined by Professor Wafa Nouioua (Department of Plant Ecology and Biology, Ferhat Abbas University, Setif 1), a specialist in Algerian flora. Identification relied on detailed macromorphological analysis of diagnostic characters: seed morphology for Foeniculum vulgare and Pimpinella anisum; floral architecture for Matricaria chamomilla; and leaf phyllotaxy for Aloysia citrodora and Mentha spp. These characters were compared against dichotomous keys and standard descriptions in Nouvelle flore de l'Algérie et des régions désertiques méridionales (Quézel & Santa, 1962-1963) and Flore de l'Afrique du Nord (Maire, 1958-1959). Scientific nomenclature was subsequently verified and updated according to the World Flora Online (WFO) database (https://www.worldfloraonline.org).

Table 2. Weed floristic composition in tobacco crops, Yaqubi field, Tehsil Razar, District Swabi.

Family	Species	Vernacular Name	Part Used	Voucher ID	Preparation Method	Ethnobotanical Uses	Frequency of use (%)
Apiaceae	*Foeniculum vulgare* Mill.	Fennel / Bisbas	Seeds, Leaves	UFS- -2024-25	Hot water infusion	Digestive disorders, nausea, bloating	83.3
Asteraceae	*Matricaria chamomilla* L.	Chamomile / Babounj	Flowers, Leaves	UFS- -2024-05	Hot water infusion	Digestive disorders, anxiety, insomnia	80.0
Verbenaceae	*Aloysia citrodora* Palau	Lemon verbena / Louiza	Leaves	UFS- -2024-29	Hot water infusion	Digestive disorders, mild anxiety	76.6
Lamiaceae	*Mentha* spp.	Mint / Naʿnaʿ	Leaves	UFS- -2024-10	Hot water infusion	Nausea, digestive discomfort	73.3
Arecaceae	*Phoenix dactylifera* L.	Dates / Tmar	Fruit	UFS- -2024-30	Direct consumption	Nutritional support, anemia	53.3
Rubiaceae	*Coffea arabica* L.	Coffee / Qahwa	Seeds (beans)	UFS- -2024-31	Boiling / decoction	Fatigue, headache	50.0
Fabaceae	*Trigonella foenum-graecum* L.	Fenugreek / Hilba	Seeds	UFS- -2024-32	Infusion / boiling	Anemia, nutritional support	46.7
Liliaceae	*Aloe vera* (L.) Burm.f.	Aloe Vera / Sabbar	Gel (leaves)	UFS- -2024-33	Direct / decoction	Skin conditions, digestive issues	23.3
Apiaceae	*Pimpinella anisum* L.	Anise / Yanson	Seeds	UFS- -2024-34	Hot water infusion	Digestive disorders, nausea	36.7
Lamiaceae	*Thymus vulgaris* L.	Thyme / Zaâtar	Leaves	UFS- -2024-35	Hot water infusion	Respiratory infections, UTI	33.3
Lamiaceae	*Salvia officinalis* L.	Sage / Salmiya	Leaves	UFS- -2024-17	Hot water infusion	Digestive disorders, uterine health	36.7
Theaceae	*Camellia sinensis* (L.) Kuntze	Green Tea / Atay akhdar	Leaves	UFS- -2024-36	Hot water infusion	Antioxidant, fatigue	33.3
Lamiaceae	*Rosmarinus officinalis* L.	Rosemary / Azir	Leaves	UFS- -2024-37	Hot water infusion	Digestive support, circulation	36.7
Zingiberaceae	*Zingiber officinale* Roscoe	Ginger / Zanjabil	Rhizome	UFS- -2024-07	Decoction / infusion	Nausea, vomiting	33.3
Linaceae	*Linum usitatissimum* L.	Flax Seeds / Kattan	Seeds	UFS- -2024-38	Infusion / direct	Constipation, nutritional support	33.3
Lamiaceae	*Cinnamomum verum* J. Presl	Cinnamon / Qarfa	Bark	UFS- -2024-39	Infusion / decoction	Digestive disorders, glycemia regulation	13.3
Zygophyllaceae	*Peganum harmala* L.	Harmal	Seeds	UFS- -2024-40	Decoction / fumigation	Traditional rituals, uterine stimulant	20.0
Asteraceae	*Artemisia absinthium* L.	Wormwood / Chih	Leaves	UFS- -2024-41	Infusion / decoction	Digestive disorders, antiparasitic	13.3
Rutaceae	*Ruta graveolens* L.	Rue / Fidjel	Leaves	UFS- -2024-42	Hot water infusion	Emmenagogue, abortifacient (contraindicated)	6.7

The following table presents the participants' opinions regarding the effectiveness and use of various medicinal plants and natural resources (Table II). The data shows that traditional herbal infusions, such as fennel, chamomile, and lemon verbena, enjoy a broad positive consensus, with over 70% approval. Conversely, more specific or bitter plants, such as rue or wormwood, show much higher "No comment" rates, suggesting they are less known or less frequently used by the respondents.

Table 2. Herbalists' perceptions regarding the use of medicinal plants during pregnancy

Plant	No comment (%)	Disagree (%)	Agree (%)	Strongly agree (%)
Fennel	13.3	3.3	80.0	3.3
Chamomile	16.7	3.3	76.7	3.3
Lemon verbena	16.7	6.7	73.3	3.3
Mint	23.3	3.3	73.3	0
Coffee	36.7	13.3	50.0	0
Flax seeds	60.0	6.7	26.7	6.7
Ginger	53.3	13.3	33.3	0
Cinnamon	73.3	13.3	13.3	0
Wormwood	66.7	20.0	13.3	0
Rue	76.7	16.7	6.7	0
Thyme	53.3	13.3	33.3	0
Sage	43.3	20.0	36.7	0
Fenugreek	36.7	16.7	43.3	3.3
Aloe Vera	53.3	23.3	23.3	0
Dates	30.0	16.7	50.0	3.3
Parsley	46.7	16.7	36.7	0
Rosemary	43.3	20.0	36.7	0
Harmal (Syrian Rue)	60.0	20.0	20.0	0
Anise	50.0	13.3	36.7	0
Green tea	40.0	26.7	33.3	0

Most effective preparation methods based on the plant part used

In traditional medicine, preparing medicinal plants is an important step to ensure the effectiveness of treatments. Depending on the part of the plant used (leaves, seeds, roots, or bark), herbal sellers use different methods to best extract the active compounds. This information helps us better understand the traditional practices and knowledge passed down about preparing plant-based remedies.

Medicinal Leaves

Concerning the preparation methods for medicinal plant leaves, the data presented in figure 6 show the following distribution: 63.3% of herbal sellers consider hot water infusion the most effective method, 13.3% prefer steam or boiling methods, and 10.0% opt for cold water infusion.

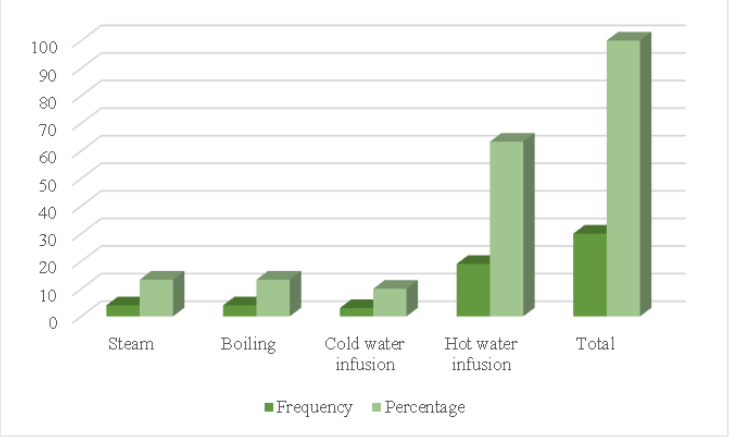

Figure 6. Traditional preparation practices of medicinal leaves.

Medicinal Seeds

With respect to the preparation methods for medicinal seeds, the data presented in figure 7 show the following distribution: 56.7% of herbal sellers consider hot water infusion the most effective method, 30.0% prefer boiling, 10.0% opt for cold water infusion, 3.3% use the seeds directly without preparation, and 0% favour steam.

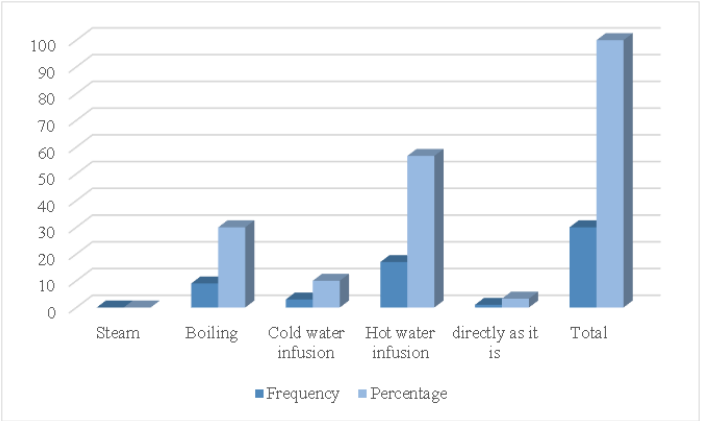

Figure 7. Traditional preparation practices of medicinal seeds.

Medicinal Roots

With respect to the preparation methods for medicinal roots, the data presented in figure 8 show the following distribution: 60.0% of herbal sellers consider boiling the most effective method, 30.0% prefer hot water infusion, and 3.3% each favour steam, cold water infusion, or using the roots directly.

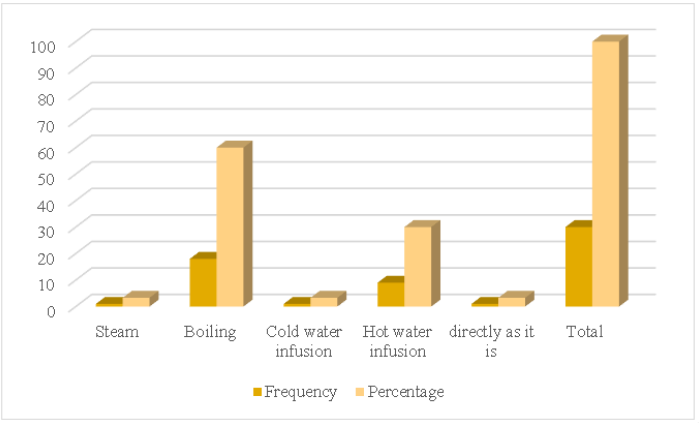

Figure 8. Traditional preparation practices of medicinal roots.

Medicinal Bark

From the figure 9, it is evident that herbal sellers are divided between two main preparation methods for bark: boiling and hot water infusion, each chosen by 43.3% of respondents. A smaller percentage favors cold water infusion (6.7%), steam (3.3%), or using the bark directly (3.3%).

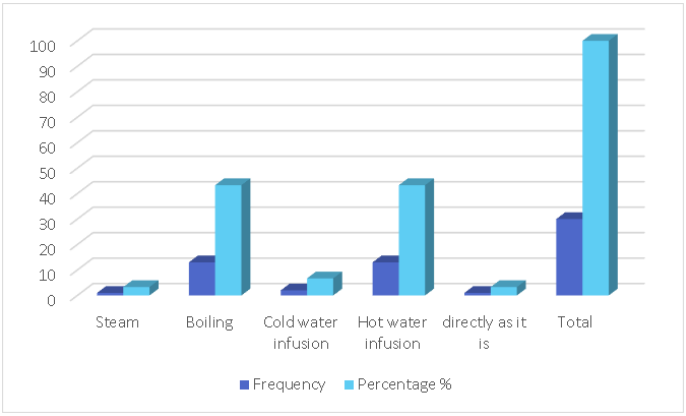

Figure 9. Traditional preparation practices of medicinal bark.

Use of Multiple Plants in traditional remedies

The data from figure 10 indicate that 86.7% of respondents support the possibility of combining two or more medicinal plants, whereas 13.3% reject it.

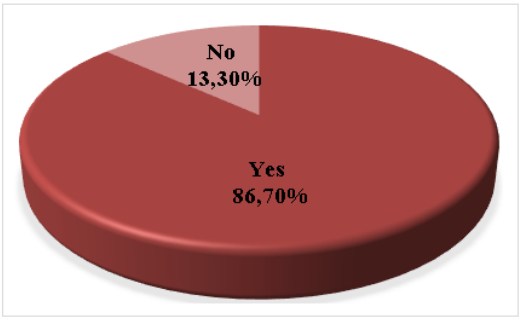

Figure 10. Opinions on combining medicinal plants.

Effects of medicinal plants section

Impact of dosage on the effectiveness and safety of medicinal plants.

Understanding the safety concerns related to the use of medicinal plants during pregnancy is essential. Dosage plays a critical role in ensuring both the mother's and fetus's health when using herbal remedies. The responses from herbal sellers reflect their awareness of these important considerations. From Figure 11, 100% of respondents agree that the dosage of medicinal plants affects the health of the pregnant woman and her foetus. This unanimous consensus highlights the crucial importance of careful dosage management in herbal treatments during pregnancy to ensure the safety and well-being of both mother and child.

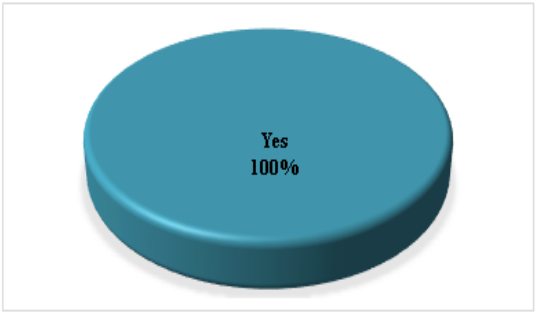

Figure 11. Importance of dosage of medicinal plants during pregnancy.

Use of medicinal plants during different stages of pregnancy.

First trimester of pregnancy

The use of medicinal plants during pregnancy is a sensitive topic, especially during the first trimester when the foetus is most vulnerable. Herbal sellers have differing opinions on the safety of consuming medicinal plants at this stage. According to Figure 12, 23.3% of respondents believe that medicinal plants can be consumed during the first trimester, while the majority, 76.7%, think otherwise.

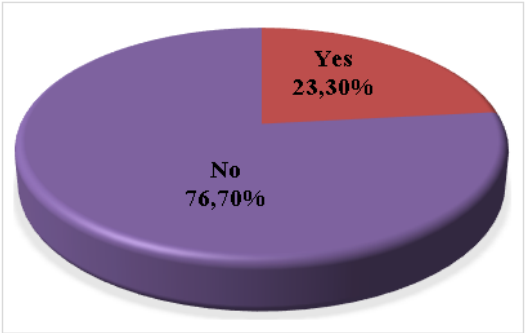

Figure 12. Opinions on the use of medicinal plants during first trimester of pregnancy.

Last trimester of pregnancy

The use of medicinal plants during pregnancy generates varying opinions, especially depending on the trimester. Understanding herbal sellers' perceptions of the safety of these natural remedies during the last trimester helps to shed light on practices and precautions taken at this sensitive stage. According to the Fig.13, 83.3% of respondents consider the use of medicinal plants during the last trimester of pregnancy to be safe, while 16.7% express reservations. Thus, the majority of sellers show strong confidence in traditional remedies in late pregnancy, although a minority remain cautious about potential risks.

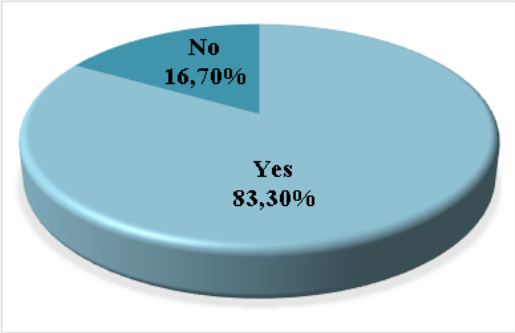

Figure 13. Opinions on the use of medicinal plants during last trimester of pregnancy.

Common reasons for using medicinal plants during pregnancy

Pregnant women often face various health issues during their pregnancy. According to the table III, digestive problems and insomnia are the most frequently mentioned reasons for using medicinal plants, each accounting for 21.8% of responses and affecting 56.7% of cases. This highlights the common occurrence of these issues during pregnancy and the trust placed in natural remedies to relieve them. Anxiety and stress also represent a significant share, with 19.3% of responses and 50.0% of cases, indicating that many pregnant women turn to medicinal plants to manage their emotional and psychological discomfort. Urinary tract infections and anaemia each account for 12.8% of responses and 33.3% of cases, reflecting notable health concerns that may encourage the use of plant-based treatments. Finally, uterine infections, although less cited (11.5% of responses and 30.0% of cases), remain an important problem leading some women to use medicinal plants. Overall, this data shows that pregnant women mainly use medicinal plants to manage common but sometimes serious disorders, highlighting the importance of natural remedies in prenatal care.

Table 3. Main disorders treated with medicinal plants in pregnant women

Clinical Symptoms	Frequency	Percent	Percent of Cases
Digestive problems	17	21.8%	56.7%
Insomnia	17	21.8%	56.7%
Urinary tract infection	10	12.8%	33.3%
Anxiety and stress	15	19.3%	50.0%
Anemia	10	12.8%	33.3%
Uterine infections	9	11.5%	30.0%
Total	**78**	**100%**	**260%**

Practical tips and guidance for the safe and effective use of medicinal plants

Many herbalists advise pregnant women to avoid using any type of substance (whether natural or chemical) during pregnancy. Responses such as "Avoid consumption of any chemical or natural substances" and "Avoid most herbs during the first and second trimester" reflect a heightened awareness of the risks involved. This caution demonstrates the herbalists' understanding that pregnancy is a sensitive stage in which both the mother and foetus could be harmed by external agents.

Several respondents highlighted the importance of dosage control, stressing that herbs should only be used in limited and safe quantities. For instance, one noted that chamomile can be useful for anxiety and stress, but only when used in small amounts. This emphasis on moderation shows an awareness of the potential for adverse effects when herbal products are overused or misused.

Another common recommendation was to seek the advice of professionals in the field of herbal medicine. Suggestions like "Consult specialists in herbal medicine" point to a responsible approach in which traditional remedies are not applied

arbitrarily but rather under expert supervision. This reflects a trend toward more regulated and informed use of herbs, especially during pregnancy.

Some herbalists gave specific warnings about certain plants, such as “The smell of rosemary harms the foetus.” This suggests deep knowledge of how specific plants (even in aromatic form) can affect pregnancy. These precise insights underline the herbalists’ experience and familiarity with both the risks and mechanisms of action of various herbs.

Despite the general caution, some herbalists recommended certain herbs for specific problems. For example, chamomile was advised for stress relief, and carob was mentioned for treating anaemia. However, these suggestions always included a caveat to respect dosage limits, reinforcing a balanced approach between benefit and safety.

Interestingly, one response advocated for combining traditional herbalism with modern medicine, suggesting a complementary approach. This hybrid perspective highlights a shift among some practitioners toward integrative health solutions, combining ancestral knowledge with contemporary clinical practices.

Discussion

The present study provides valuable insights into herbalists' perceptions and practices regarding the use of medicinal plants during pregnancy in Sétif province. Overall, the findings reveal a strong awareness among herbalists of both the therapeutic potential and the possible risks associated with plant-based remedies. A high level of consensus was observed regarding the impact of botanicals on pregnant women, with nearly all respondents acknowledging their effects. This finding is consistent with previous studies showing that herbal practitioners generally recognize the biological activity of medicinal plants and their potential influence on maternal health (El Hajj & Holst 2020, Sarecka-Hujar & Szulc-Musioł 2022). Indeed, increasing evidence suggests that herbal medicine providers are aware that these substances contain pharmacologically active compounds capable of producing both therapeutic and adverse effects, particularly during sensitive periods such as pregnancy (Al-Tawalbeh *et al*. 2024).

The recognition of potential side effects by the majority of respondents reflects a cautious and responsible approach. Similar observations have been reported in previous studies, which emphasize that herbs, although natural, may pose risks during pregnancy due to their pharmacological properties (El Hajj & Holst 2020). Indeed, many plant-based remedies contain bioactive compounds capable of crossing the placental barrier or influencing uterine activity, thereby potentially affecting maternal and foetal health (Akbaribazm *et al*. 2021, Al-Tawalbeh *et al*. 2024).

The interaction between pregnant women and herbalists reflects active health-seeking behaviour, as most women actively inquire about the safety of botanicals before use. This observation is supported by recent studies indicating that pregnant women increasingly seek information from both traditional practitioners and healthcare providers to ensure informed and safe choices regarding herbal remedies during pregnancy (Belayneh *et al*. 2022). In addition, research conducted in various regions has shown that women are not passive users of herbal medicine but are actively engaged in evaluating potential risks and benefits, often influenced by cultural beliefs as well as growing awareness of possible adverse effects (Mothupi 2014, Adeoye & Etuk 2023). This pattern highlights a shift toward more informed decision-making and prudent use of medicinal plants during pregnancy, even in settings where traditional medicine remains highly prevalent (John & Shantakumari 2015).

Regarding specific plants, the results show varying levels of acceptance among respondents. Herbs such as fennel (*Foeniculum vulgare*), chamomile (*Matricaria chamomilla*), lemon verbena (*Aloysia citrodora*), and mint (*Mentha* spp.) were widely accepted. These findings align with previous studies reporting that these botanicals are commonly used during pregnancy to manage digestive disorders, nausea, and mild anxiety (Sarecka-Hujar & Szulc-Musioł 2022, Adeoye & Etuk 2023). However, the presence of neutral responses suggests some uncertainty among herbal sellers regarding appropriate dosage, safety, and trimester-specific use. This reflects a broader concern in the literature that, although these plants are perceived as safe and natural, insufficient evidence exists on standardized doses and potential interactions during pregnancy (Belayneh *et al*. 2022).

In contrast, plants such as rue (*Ruta graveolens*), wormwood (*Artemisia absinthium*), and harmal (*Peganum harmala*) showed high levels of uncertainty or rejection among respondents. This stance is likely due to their well-documented toxic or abortifacient properties: rue is recognized for its emmenagogue effects, wormwood contains thujone, a neurotoxic

compound, and harmal seeds contain beta-carboline alkaloids, which can induce uterine contractions and affect foetal development (El Hajj & Holst 2020, Balarastaghi *et al*. 2022, Sarecka-Hujar & Szulc-Musioł 2022).

The findings also highlight the importance of preparation methods and dosage, two factors that the vast majority of respondents considered critical. Hot water infusion and boiling were the most commonly used techniques, consistent with ethnopharmacological studies emphasizing that extraction methods play a decisive role in determining both the efficacy and safety of plant-based remedies, as they directly influence the concentration of bioactive compounds (Kennedy *et al*. 2013). In this regard, the unanimous agreement on dosage echoes Paracelsus's principle that "the dose makes the poison," a concept particularly relevant during pregnancy, when variations in dose, preparation, and frequency of use can have significant consequences on maternal and foetal health (El Hajj & Holst 2020). The vigilance observed among herbalists, especially concerning use during the first trimester, further reflects awareness of foetal vulnerability, given that early pregnancy represents a critical window during which exposure to bioactive substances may lead to teratogenic effects or other complications (Sarecka-Hujar & Szulc-Musioł 2022).

Overall, although medicinal plants are widely used and trusted, herbalists demonstrate a predominantly cautious approach. This highlights the need for further scientific research to establish evidence-based guidelines and for improved integration of traditional and modern medical knowledge, ensuring the safe use of medicinal plants during pregnancy (Al-Tawalbeh *et al*. 2024).

Conclusion

This study provides a comprehensive overview of herbalists' perceptions and practices regarding the use of medicinal plants during pregnancy in Setif province. The findings demonstrate a strong awareness among herbal sellers of both the therapeutic potential and the risks associated with plant-based remedies, with nearly all respondents acknowledging their effects on pregnant women's health. This reflects a predominantly cautious and responsible approach within the local herbal medicine community.

The classification of plants according to herbalists' perceptions revealed a clear spectrum of acceptance. Widely used botanicals such as fennel (*Foeniculum vulgare*), chamomile (*Matricaria chamomilla*), lemon verbena (*Aloysia citrodora*), and mint (*Mentha* spp.) were broadly accepted for managing common pregnancy-related complaints, including digestive disorders, nausea, and mild anxiety. In contrast, plants such as rue (*Ruta graveolens*), wormwood (*Artemisia absinthium*), and harmal (*Peganum harmala*) were met with significant caution or rejection, consistent with their well-documented abortifacient and toxic properties.

The study also highlighted the critical role of preparation methods and dosage in determining both the efficacy and safety of herbal remedies during pregnancy. Hot water infusion and boiling were the most employed techniques, and unanimous agreement was observed among respondents regarding the influence of dosage on maternal and foetal health. Furthermore, herbalists demonstrated particular vigilance toward use during the first trimester, reflecting awareness of the heightened vulnerability of the developing foetus during this critical period.

Taken together, these findings underscore the need to bridge traditional herbal knowledge with evidence-based medicine. While medicinal plants remain a deeply rooted component of prenatal care in the region, the absence of standardized guidelines on dosage, preparation, and trimester-specific safety represents a significant gap. Future research should prioritize pharmacological validation of the most commonly used species, the development of evidence-based recommendations tailored to pregnancy, and the integration of traditional practitioners into broader maternal healthcare frameworks. Such efforts would contribute to ensuring the safe and informed use of medicinal plants during pregnancy, while preserving the valuable ethnobotanical heritage of the Setif region.

Declarations

List of abbreviations: SPSS: Statistical Package for the Social Sciences; UTI: Urinary Tract Infection; WFO: World Flora Online; QGIS: Quantum Geographic Information System.

Ethics approval and consent to participate: The study was conducted in accordance with ethical and legal guidelines for research involving human participants. Participation of herbalists was entirely voluntary, and informed consent was obtained prior to completion of the questionnaire. Respondents were assured of the confidentiality of their responses, the anonymity of all collected data, and their right to withdraw from the study at any time without consequence.

Nagoya Protocol / Access and Benefit-Sharing (ABS) Compliance: The present study complies with the principles established by the Nagoya Protocol regarding access to genetic resources and the equitable sharing of benefits derived from their use. Since Algerian ABS regulations primarily concern the commercial exploitation of genetic resources, this study falls outside their direct scope, as no plant material was collected or exported for commercial purposes. All information was gathered exclusively through direct interviews with herbalists, focusing on traditional knowledge related to medicinal plant use during pregnancy. Given that no physical specimens were collected, no herbarium deposits or Material Transfer Agreements were necessary. All herbalists who participated in the study were fully informed about the research objectives, the voluntary nature of their involvement, and how the collected data would be used, and their consent was obtained accordingly. To ensure the protection of traditional knowledge, all collected data were anonymized and presented in aggregate form, thereby preserving the confidentiality of participants.

Consent for publication: Informed consent for the publication of the study findings was obtained from all herbalists who participated in this research. Throughout the manuscript, no personal or identifying information relating to any participant has been disclosed, in full respect of their privacy and confidentiality.

Availability of data and materials: The datasets generated and/or analysed during the current study are available from the corresponding author, Soraya MADOUI, upon reasonable request.

Competing interests: The Authors declare that there is no conflict of interest.

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Author contributions: S. M. and H. K. contributed to data interpretation, fieldwork, and manuscript revision. K. M. performed plant identification, S. A. H. contributed to the theoretical background, R. A. collected ethnobotanical data, carried out data analysis, contributed to the theoretical background, and wrote the initial manuscript, while S. M. and H. K. supervised data collection and analysis, assisted with discussions, and prepared the final version of the manuscript.

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Literature cited

Adeoye I, Etuk V. 2023. Prevalence, predictors and pregnancy outcomes of unprescribed and herbal medicine use in Ibadan, Nigeria. BMC Complementary Medicine and Therapies 23(1):17. doi:10.1186/s12906-023-03838-8

Akbaribazm M, Goodarzi N, Rahimi M. 2021. Medicinal properties of Foeniculum vulgare Mill. in traditional Iranian medicine and modern phytotherapy. Food Science and Nutrition 9(10):5869-5882. doi:10.1002/fsn3.2509

Al-Tawalbeh D, Hamdan F, Al-Momani E, Atiyeh H, Mayyas A. 2024. Investigating pregnant women's attitudes toward herbal remedies: a cross-sectional study. International Journal of Environmental Research and Public Health 21(10):1290. doi:10.3390/ijerph21101290

Balarastaghi S, Delirrad M, Jafari A, Karimpour M, Gholizadeh-Ghani S, Ilkhanizadeh B, Kheirkhah AA. 2022. Potential benefits versus hazards of herbal therapy during pregnancy; a systematic review of available literature. Phytotherapy Research 36(4):824-841. doi:10.1002/ptr.7363

Belayneh YM, Yoseph T, Ahmed S. 2022. A cross-sectional study of herbal medicine use and contributing factors among pregnant women on antenatal care follow-up at Dessie Referral Hospital. BMC Complementary Medicine and Therapies 22(1):93. doi:10.1186/s12906-022-03567-4

El Hajj M, Holst L. 2020. Herbal medicine use during pregnancy: A review. Frontiers in Pharmacology 11:1549. doi:10.3389/fphar.2020.01549

Gangakhedkar GR, Kulkarni AP. 2021. Physiological changes in pregnancy. Indian Journal of Critical Care Medicine 25(3):S189-S192. doi:10.5005/jp-journals-10071-23856

John LJ, Shantakumari N. 2015. Herbal medicines use during pregnancy: A review from the Middle East. Oman Medical Journal 30(4):229-236. doi:10.5001/omj.2015.48

Kennedy DA, Lupattelli A, Koren G, Nordeng H. 2013. Herbal medicine use in pregnancy: results of a multinational study. BMC Complementary and Alternative Medicine 13:355. doi:10.1186/1472-6882-13-355

Maire R. 1958-1959. Flore de l'Afrique du Nord. Paris: Lechevalier.

Mothupi MC. 2014. Use of herbal medicine during pregnancy among women with access to public healthcare in Nairobi, Kenya: a cross-sectional survey. BMC Complementary and Alternative Medicine 14:432. doi:10.1186/1472-6882-14-432

Quézel P, Santa S. 1962-1963. Nouvelle flore de l'Algérie et des régions désertiques méridionales. Paris: CNRS.

Sarecka-Hujar B, Szulc-Musioł B. 2022. Herbal medicines — Are they effective and safe during pregnancy? Pharmaceutics 14(1):46. doi:10.3390/pharmaceutics14010046

Soma-Pillay P, Nelson-Piercy C, Tolppanen H, Mebazaa A. 2016. Physiological changes in pregnancy. Cardiovascular Journal of Africa 27(2):89-94. doi:10.5830/CVJA-2016-021

Tesfaw AG, Workneh BD, Kahissay MH. 2021. Herbal medicines use and associated factors among pregnant women in Debre Tabor town, north West Ethiopia: a mixed method approach. BMC Complementary Medicine and Therapies 21:268. doi:10.1186/s12906-021-03439-3