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Ethnobotanical study of medicinal plants used by pregnant women in the Beni Mellal-Khenifra region, central Morocco

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ABSTRACT

Despite advances in modern medicine, limitations persist. In response, scientific research is revisiting the benefits of natural products, particularly homeotherapy. Limited healthcare access in developing countries is another factor driving the population towards traditional medicine. Herbal medicine is viewed as a viable alternative, especially among pregnant women, despite limited safety data. This study aims to document the use of medicinal plants by pregnant and postpartum women in Beni Mellal-Khenifra region and identify associated factors. A cross-sectional survey was conducted with 400 postpartum women in the maternity ward of the regional hospital of Beni Mellal. Most women (63.75%) reported using medicinal plants during pregnancy, labor, and after dilevery. Significant correlations were found between medicinal plants usage and family structure, residence, and education level (p<0.05). The study identified 20 plant species used for various health issues, with *Lepidium sativum*, *Peganum harmala*, and *Trigonella foenum-graecum* being the most common. Medicinal plants were used for dietary, cosmetic, and therapeutic purposes, with gastrointestinal disorders, urinary tract infections, and anemia being the most frequently treated conditions. Adverse effects were reported by 5.88% of users. Family and friends constituted the primary source of information (34.73%). Pregnant women in the Beni Mellal-Khenifra region widely utilize herbal medicine for various purposes, despite the potential risks associated with certain remedies. There is a pressing need for enhanced education and awareness regarding the safe use of herbal medicine during pregnancy.

Keywords : Medicinal plants, Pregnant women, Beni Mellal-Khenifra.

INTRODUCTION

Despite the progress in modern medicine, certain limitations remain, including the emergence of drug resistance, side effects and toxic reactions due to overconsumption, as well as the growing prevalence of lifestyle diseases such as diabetes, obesity, cancer, and autoimmune disorders, which are often expensive to treat. In response to these challenges, scientific research is once again focusing on natural products, aiming to deepen the empirical knowledge accumulated on homeotherapy.

In developing countries, due to challenges in accessing healthcare services and the limited availability of medical care, people naturally gravitate towards traditional medicine, where Medicinal Plants (MPs) play a vital role. According to the World Health Organization (WHO), 80% of the world's population, especially in developing countries, uses a variety of traditional medicines for their primary health care [1].

In Morocco, It has been estimated that 50% to 75% of the population depends on the use of MPs for their remedies [2]. This practice is enhanced by the country's rich floral and landscape diversity, offering a unique potential in medicinal and aromatic plants. This makes it one of the most fascinating regions biologically and biogeographically [3]. Thus, moroccan flora consists of more than 7000 species and subspecies among which approximately 800 are medicinal and aromatic plants [4].

Indeed, given the belief in the harmlessness of MPs due to their natural origin, their use was increasingly considered a reasonable and safer alternative to conventional therapy. Since, pregnant women preferred the use of MPs rather than prescription drugs, even though information on their safety and efficacy are very limited. In addition, the side effects associated with the use of MPs were sometimes accepted by users [5-6]. However, data on the extent of MPs use during pregnancy are limited [7]. Studies conducted in Marrakech indicate that 42% of women have used MPs to relieve the progress of the pregnancy, childbirth and the postpartum period [8]. Moreover, in the province of Guelmim, 66.96% of women used MPs during pregnancy [7].

In the Beni Mellal-Khenifra region, where access to healthcare services is hindered by various obstacles and limited medical resources, the doctor-to-population ratio is particularly low, with only one doctor for every 2,545 inhabitants, well below the national average of one doctor per 1,397 inhabitants [9]. Consequently, there is a natural inclination among the population to turn to traditional medicine, where MPs play a fundamental role. However, the use of these plants by pregnant women in the region has not been previously documented. Therefore, the aim of this study was to document the utilization of MPs by pregnant women in the Beni Mellal-Khenifra region of Morocco and to identify the associated factors.

MATERIAL AND METHODS

Study design and area

The study was conducted as a questionnaire-based cross-sectional survey in the maternity ward of the regional hospital of Beni Mellal from Mars to June 2024.

Study population and Sampling

Information was collected from pregnant and postpartum women in the maternity ward of the regional hospital of Beni Mellal regarding their use of MPs. A simple random sampling method was employed to recruit participants. The sample size was calculated based on the following parameters : expected births in the Beni Mellal-Khenifra region in 2024, as estimated by the Ministry of Health and Social Protection (MHSP), which is 684703 [10], a margin of error of 5%, and a confidence level of 95% ($z = 2.14$). Consequently, the minimum required sample size for this study was determined to be 384, which was rounded up to 414 to enhance precision and account for potential exclusions. After data purification, 14 questionnaires with missing data or illegible writing were eliminated, resulting in a final sample size of 400.

Data analysis

Statistical analysis was carried out using Sphinx Plus2 software. Frequencies and percentages were calculated and X^2 tests was employed to correlate categorical variables. In all analyses, a *p*-value of less than 0.05 was considered statistically significant.

Ethical approval

This study was conducted in strict adherence to local ethical guidelines. Ethical approval was obtained from the administration of the regional hospital of Beni Mellal. All necessary precautions were taken to ensure the anonymity and confidentiality of participents information through the use of a coding system. No hazardous substances were employed in the study, thereby eliminating any potential ethical concerns related to substance use. Participation was entirely voluntary, and all participants provided informed consent prior to their involvement in the study.

RESULTS

The mean age of the women participating in the study was 29.20 years, with a range from 18 to 42 years. Among the participants, 55% lived in rural areas, while 45% resided in towns. In

terms of family structure, 53.75% were part of nuclear families, and 46.25% lived in extended families. Parity data showed that 63.75% were primiparous and 36.25% were multiparous. Regarding educational levels, 20% of the women had attained university education, 15% had completed high school, 8.5% had secondary education, and 35% were illiterate (table 1).

During the survey period, 255 out of 400 women who gave birth and were part of the study (63.75%) reported using MPs during pregnancy, childbirth, and postpartum. Statistical analysis showed a very significant relationship between MPs usage and family structure (p = 0.001), place of residence (p = 0.001), and education level (p = 0.001) (Table 1).

Table 1. Relation betwen MPs usage and sociodemographic characteristics

Sociodemographic characteristics		MPs usage (N = 400) n (%)		*p*-Value
		User	**Non-user**	
		255 (63.75)	145 (36.25)	
Age	<20	65 (25.5)	30 (20.69)	0.4591
	20-24	45 (17.65)	39 (26.9)	
	25-29	70 (27.45)	30 (20.69)	
	30-34	35 (13.72)	25 (17.24)	
	35-39	39 (15.3)	21 (14.48)	
	40 and over	1 (0.003)	0 (0.00)	
Family structure	Extended family	180 (70.58)	5(3.45)	0.0001
	Nuclear family	75 (29.42)	140 (96.55)	
Place of residence	Urban	80 (31.37)	100 68.96)	0.0001
	Rural	175 (68.63)	45 (31.03)	
Education level	Illiterate	140 (54.9)	0(0.00)	0.0001
	Primary	80 (31.37)	5 (3.45)	
	Secondary	35 (13.72)	0 (0.00)	
	High school	0 (0.00)	60 (41.38)	
	University	0 (0.00)	80 (55.17)	
Parity	Primiparous	145 (56.9)	75 (51.72)	0.4307
	Multiparous	110 (43.14)	70 (48.27)	

Our results showed that a variety of plant species were traditionally used by pregnant women. We have collected information on 20 plant species belonging to 17 botanical families. The Lamiaceae family was the most represented (4 species). All the listed plants are presented in table 2. The Relative Frequency of Citation (RFC) ranged from 0.15 to 0.21. The most commonly used plants were *Lepidium sativum* (Garden cress) (RFC = 0.21), *Peganum harmala* (African rue) (RFC = 0.11), and *Trigonella foenum-graecum* (Fenugreek) (RFC = 0.10).

Regarding the reasons of use, MPs were utilized for dietary, cosmetic, and therapeutic purposes. In therapeutic settings, pregnant women commonly used MPs to manage or prevent a range of 10 specific health issues. The most treated conditions were gastrointestinal disorders (38.43%), urinary tract infections (23.92%), and anemia (20.78%). Only 5.88% of MPs users reported adverse effects such as allergies or gastrointestinal disorders.

In terms of preparation methods, MPs were either used alone (39%) or in combination with other natural products (51%), with honey being the most frequently paired product (40%). Various routes were used for the administration of herbal preparations. The oral route was the most common (73.21%), followed by the vaginal route (20.53%), and then the nasal route (3.84%). Pregnant women primarily based their decisions to use MPs on advice from family and friends (34.73%).

Table 2. List of MPs used by pregnant women

Family	Scientific Name	English name	Arabic name	Method of preparation	Time	RA	FRC	Reason for Use	Side effects
Amaranthaceae	*Dysphania ambrosioides*	Mexican tea	Mkhinza	Infusion Decoction	DP	Oral Dermal	0.019	Fever ; Gastric pain ; Hair loss	No effect
Asteraceae	*Artemisia herba alba*	Desert wormwood	chih	Decoction with lavande and Thymus	AD	vaginal	0.015	Episiotomy care	No effect
Brassicaceae	*Lepidium sativum*	Garden cress	Habrchad	Raw Powder	DP AD	Oral	0.21	Loss of appetite ; Breast milk production ; Getting back in shape AD	No effect
Cupressaceae	*Tetraclinis articulata*	Tetraclinis	Aârar	Decoction Powder with Henna	DP	Oral Dermal	0.015	Gastric pain ; Hair loss	No effect
Fabaceae	*Trigonella foenum-graecum*	Fenugreek	Halba	Raw Powder with honey	DP AD	Oral Local	0.098	Melasma ; Anemia ; Gastric pain Loss of appetite ; Breast milk production ; Getting back in shape AD	No effect
Lamiaceae	*Lavandula angustifolia Mill.*	Lavande	Khzama	Decoction	DP AD	Vaginal	0.082	Genitourinary infections Episiotomy care	No effect
	Mentha suaveolens Ehrh.	Apple mint	Timija, Mersita	Infusion, Decoction	DP	Oral	0.019	Gastric pain ; Cold/flu/cough	No effect
	Thymus vulgaris	*Thymus*	*Ziitra*	Infusion with honey Decoction	DP AD	Oral Vaginal	0.035	Gastric pain ; Genitourinary infections Cold/flu/cough	No effect
	Salvia rosmarinus	Rosemary	Azir	Infusion Decoction	DP	Oral Vaginal Dermal	0.019	Genitourinary infections ; Hair loss Gastric pain	No effect
Lauraceae	*Cinnamomum zeylanicum Blume*	Cinnamon	Qarfa	Infusion Powder with honey and olive oil	DL	Oral	0.039	Induce labor (induction) Ease childbirth (accelerate labor)	Hemorrhage
Lythracea	*Lawsonia inermis*	Henna tree	Lhenna	Powder	AD	Vaginal	0.019	vaginal tightening	No effect
Myrtaceae	*Syzygium aromaticum*	Clove	Korenfal	Infusion ; Decoction Raw	DP DL	Oral	0.019	Gingival bleeding ; Induce labor Cold/flu/cough ; Genitourinary infections	No effect
Nitrariaceae	*Peganum harmala*	African rue	Harmal	Decoction ; Fumigation with alum	DL	Oral Nasal	0.117	Ease childbirth (accelerate labor) Induce labor (induction)	Allergy

Oleaceae	*Olea europaea*	Olive	Zit laoud	Oil	DP AD	Vaginal Dermal	0.019	Prevent perineal tears ; Stretch marks Ease childbirth (accelerate labor) ; Hair loss	No effect
Pedaliaceae	*Sesamum indicum*	Sesame	Zanjlan	Powder Decoction Raw	DP AD	Oral	0.031	Anemia ; Breast milk production ; Loss of appetite ; Getting back in shape AD	No effect
Ranunculaceae	*Nigella sativa*	Black Seed	Sanouj, Habba saouda	Raw Powder with honey	DP DL	Oral	0.019	Getting back in shape AD Gastric pain ; Ease childbirth (accelerate labor) ; Induce labor ; Cold/flu/cough	No effect
Rubiaceae	*Rubia peregrina*	Madder	Foua	Powder with honey	DP AD	Oral	0.078	Anemia	No effect
Sapotaceae	*Argania spinosa Sapotaceae*	Argan	Zit Argan	Oil	DP AD	Dermal	0.019	Stretch marks	No effect
Verbenaceae	*Aloysia citriodora* Palau	Verbena	Luisa	Infusion with honey Decoction	DP AD	Oral	0.019	Vomiting ; Constipation ; Gastric pain ; Insomnia ; Stress/anxiety	No effect
Zingiberaceae	*Zingiber officinale*	Ginger	Skinjbir, Zanjabil	Infusion with honey Decoction	DP	Oral		Cold/flu/cough	No effect

AD : After Dilevery **; DL** ; During Labor ; **DP** : During Pregnancy ; **FRC :** Relative Frequency of Citation **; RA :** Route of administration

DISCUSSION

The results of the ethnobotanical survey showed that pregnant and postpartum women in the Beni Mellal-Khenifra region possess knowledge of obstetric care using MPs. Of the 400 women who underwent birth and were consulted during the survey period, 255 (63.75%) have used MPs to alleviate the progress of the pregnancy, labor and after delivery. This indicates a substantial reliance on traditional medicinal practices within this community. This observation is congruent with a study conducted in the province of Guelmim (southern Morocco), which documented that 66.96% of pregnant women utilized MPs [7]. Conversely, a study carried out in Marrakech reported a lower prevalence, with only 39.7% of women admitting to using MPs during pregnancy [8]. This disparity in findings may be ascribed to variances in the availability and accessibility of healthcare services across distinct regions in Morocco. According to data sourced from the MHSP, Marrakech-Asfi region boasts 452 primary healthcare facilities, in contrast to 288 and 99 facilities in Beni Mellal-Khenifra and Guelmim-Oued Noun regions, respectively. Furthermore, in terms of qualified personnel, Marrakech-Asfi benefits from a larger workforce, with 769 midwives, whereas Beni Mellal-Khenifra and Guelmim-Oued Noun region have 322 and 184 midwives, respectively [10]. Hence, the relatively elevated prevalence of MPs usage among pregnant women observed in both our study and the one conducted in the province of Guelmim could be linked to the hurdles encountered in accessing medical services. These challenges may lead this demographic to rely on traditional medicine as an alternative.

Statistical analysis revealed a highly significant association between MPs usge and variables such as family structure ($p = 0.001$), place of residence ($p = 0.001$), and educational attainment ($p = 0.001$). Women living in nuclear families, residing in urban areas, and having a high level of education were less likely to use MPs. Similar results were reported in previous studies [7,11]. Furthermore, studies have shown that the MPs usage can also be influenced by other factors such as age, education of husbands and multiparity/nulliparity [5, 12, 13,14]. However, contrary findings from other studies indicate that sociodemographic characteristics showed no significant association with the use of MPs during pregnancy [15-17].

Regarding the botanical families of MPs used by pregnant women in our survey, Lamiaceae family was the most prominently represented. This preference may stem from factors such as the local availability of these plants and their well-recognized specific properties. Yousra (2019) emphasized that Lamiaceae constituted 16.10% of the total plant families identified in Beni Mellal-Khenifra region [18]. Furthermore, El-Gharbaoui et al. (2017) underscored that Lamiaceae are widely employed in mediterranean and eastern andalusian ethnobotany due to their established therapeutic benefits [19].

In our study, alongside the 63.75% usage rate of MPs among pregnant women, adverse effects were reported in only 5.88% of cases. These findings suggest a high level of confidence in the safety of these plants during pregnancy, despite the lack of substantial scientific evidence supporting their safety [20, 21]. This observation is consistent with a study conducted in Brazil, where 60% of participants did not recognize the toxic effects of MPs, and approximately 39% were unaware of their potential adverse effects [22]. Similarly, another study among palestinian women showed that 82.5% of pregnant women believe that herbs are safer than medications [23]. Our study further contributed to this understanding by identifying that pregnant women used 20 species of MPs. While some MPs showed beneficial effects during pregnancy, labor and after delivry, others (7/20) were found to have adverse effects on fetal development, necessitating caution and highlighting contraindications for their use during pregnancy. For instance, *Peganum harmala* (african rue) has been associated with abortifacient effects and moderate neonatal distress [24]. Moreover, study conducted by Laadraoui et al. (2018) highlighted that transplacental exposure to *Artemisia herba alba* (desert wormwood) affects reproduction by increasing infertility, delaying memory

function, and impairing neuromotor reflexes in mouse offspring [25]. Additionally, according to Orief et al. (2014), *Trigonella foenum-graecum* (fenugreek) should be consumed with caution during pregnancy because the seeds have the ability to lower blood sugar levels and stimulate uterine contractions [26]. Seddiki et al. (2017) strongly contraindicated the use of fenugreek in pregnant women, as several studies have established links between the consumption of fenugreek seeds and the occurrence of malformations (hydrocephalus, spina bifida, and microcephaly) in the fetus [27]. Furthermore, significant growth retardation, coordination and movement disorders at birth, and motor deficiencies at an advanced age have been documented in other scientific studies following the consumption of fenugreek seeds [28-30]. *Nigella sativa* (black seeds) also have been well-documented as potentially harmful during pregnancy. Ethnobotanical investigations have consistently indicated that it may induce abortion by lowering Human Chorionic Gonadotropin (HCG) levels and prompting menstrual cycles [31-34]. Similarly, studies highlight that *Cinnamomum verum* (cinnamon) has contraindications during pregnancy, potentially leading to fetal alterations, abortions, toxicity, and maternal complications [35,36]. Furthermore, according to the study conducted by Ramadhani et al. (2020), *Thymus vulgaris* (thyme) is identified as potentially harmful during pregnancy [36]. Additionally, *Zingiber officinale* (ginger) should be consumed with caution by pregnant women. While its consumption in typical food quantities is considered safe for both mother and fetus [37], doses of dried ginger exceeding 2.0 g per day are not recommended [38]. Moreover, when combined with other plants, ginger can cause pharmacological interactions. In this regard, It has been shown that the concurrent use of ginger and garlic can potentiate their antiplatelet effects, thereby increasing the risk of bleeding in pregnant women [39].

The results of our study indicated that MPs were utilized for dietary, cosmetic, and therapeutic purposes. Particularly in therapeutic contexts, pregnant women utilized MPs to manage or prevent 10 distinct diseases and symptoms, gastrointestinal disorders were the most frequently treated (38.43%), followed by urinary tract infections (23.92%) and anemia (20.78%). This findings align with other national and international studies, which also confirmed that gastrointestinal disorders, urinary tract infections, and anemia were the most common reasons for pregnant women to use MPs [7,23].

The prevalence of gastrointestinal disorders and anemia during pregnancy can be explained by the heightened demand for essential nutrients like iron, folate, and proteins critical for supporting fetal growth and maternal health. However, many pregnant women face challenges in meeting these nutritional needs due to pregnancy-related gastrointestinal issues such as nausea, vomiting, and appetite fluctuations. These factors can contribute to deficiencies in iron and other vital nutrients, thereby increasing susceptibility to anemia. Research have consistently showed a statistical association between anemia and pregnancy [40]. Furthermore, physiological changes during pregnancy increase susceptibility to urinary tract infections among women [41]. A prior investigation we conducted at the Clinical Laboratory of the Regional Hospital (CLRH) in Beni Mellal revealed that 16.67% of positive urine cultures originated specifically from the maternity ward [42].

Regarding the method of preparation, MPs used by pregnant women in this study were either employed alone (39%) or combined with other natural products (51%), with honey being the most frequently associated product (40%). This observation is echoed by another regional study focusing on phytotherapy, which found that 32.07% of recipes included honey as an ingredient [43]. This observation can be attributed to the local availability of the product, given that the Beni Mellal-Khenifra region ranks third nationally in honey production [44], as well as cultural beliefs that underscore the significance of honey. Consequently, honey serves as a predominant ingredient in both dietary practices and traditional medicine in Morocco [45].

In this study, the most common route of MPs administration among pregnant women was oral intake (56.22%). Similar findings have been reported in related studies [7, 23,43], indicating a widespread preference for thisroute of administration.

The primary source of information on herbal medecine was found to be family and friends, a trend consistent with other studies [7, 23]. This underscores the importance of reliable counseling, as some traditional practices may lack scientific evidence to support their safe use during pregnancy [23, 36].

This study is subject to several acknowledged limitations. It relies on self-reported data collected through interviews, which introduces potential biases such as interviewer bias and recall bias, thereby increasing the likelihood of underreporting. To mitigate these biases, we employed a semi-structured interview approach focused exclusively on current pregnancy. Furthermore, we sought to reduce interviewer bias by utilizing multiple interviewers (the principal researcher and a local research assistant) throughout the study. Regarding plants identification, this survey did not specifically target herbalists, complicating the identification of MPs species. Consequently, varying interpretations of vernacular plant names used in interviews may have impacted the results. Some plants possess multiple vernacular names, and a single vernacular name could refer to multiple plant species, exemplified by the case of *A. herba alba* (Chih). To mitigate this influence, the interviewer employed a non-directive interview approach guided by a predefined list and occasionally supplemented by photographs taken with a smartphone. Furthermore, since this study was conducted in the maternity ward of the regional hospital of Beni Mellal, its findings may not be generalizable to other contexts. However, these limitations were offset by several strengths, including a high response rate (100%), no missing data, and the novelty of being the first study of its kind in the Beni Mellal-Khenifra region.

CONCLUSION

The study reveals that the use of MPs is common among pregnant women in the Beni Mellal-Khenifra region. This practice appears to be linked to barriers in accessing modern healthcare, with sociodemographic factors playing a critical role. While some plants are beneficial, others pose risks to pregnancy and fetal health. It is essential to raise awareness among women and ensure proper medical supervision. Further research is needed to establish recommendations based on solid scientific evidence.

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Conflict of interest

Authors declare no conflict of interest.

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