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Ethnobotanical Use of Medicinal Plants to Induce Labor in the Province of Taza (Morocco): Prevalence, Practices, Complications, and Public Health Implications

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Abstract

Introduction: The use of medicinal plants for obstetric purposes is common in rural areas of Morocco. Some species may have uterotonic effects or pose risks during pregnancy, but local data remain limited. ***Objectives:*** To document the prevalence and characteristics of plant use to induce labor in the province of Taza, to identify the species and modes of preparation, to describe reported complications, and to analyze associated sociodemographic factors. ***Materials and Methods:*** A cross-sectional survey was conducted from April to November 2024 among pregnant or breastfeeding women attending health centers in the province of Taza. Data were collected using a questionnaire administered by midwives and analyzed with SPSS v.21 (descriptive statistics; Pearson's chi-square test for education level; Spearman's rank correlation for age; significance threshold $p < 0.05$). ***Results:*** Of the 102 participants, 37.3% reported using plants to induce labor, accounting for 58 distinct recipes. The most frequently cited species were *Cinnamomum verum J* (cinnamon; 25 cases), *Thymus vulgaris L.* (thyme; 14 cases), *Matricaria chamomilla L* (chamomile), and *Trigonella foenum-graecum L.* (fenugreek). Preparations were mainly in the form of infusions and decoctions, with a few cases involving abdominal massage. Reported complications included uterine hemorrhage, intense contractions, rapid labor progression, and three spontaneous abortions associated with the consumption of cinnamon and/or fenugreek. Use was predominantly non-medicalized (94.3%), with family and social networks being the primary source of information (94.3%). The practice was significantly associated with lower educational level ($\chi^2 = 22.503$; $p < 0.001$) and showed a negative correlation with age (rho = −0.485; $p < 0.001$). ***Conclusion:*** The use of plants to induce labor is frequent in Taza and is often practiced without medical supervision, potentially exposing women to obstetric risks. There is a need to strengthen community health education, systematically screen for traditional practices during antenatal consultations, and undertake targeted pharmacovigilance studies.

Keywords: Medicinal plants; Phytotherapy; Labor induction; Pregnancy; Traditional medicine; Pharmacovigilance.

INTRODUCTION

The use of medicinal plants is deeply rooted in the traditions of societies worldwide, particularly in rural areas where access to medical care is often limited. The World Health Organization (WHO) estimates that approximately 80% of the global population relies on traditional medicine for primary health care [1]. The use of medicinal plants during pregnancy and breastfeeding is a common practice in many parts of the world, especially in developing countries, where limited access to modern healthcare frequently drives populations to resort to herbal medicine [2]. This practice is based on traditional knowledge passed down from generation to generation, often without prior medical consultation [3]. In Morocco, the use of medicinal plants is widespread, particularly in rural areas, owing to the strong cultural value placed on natural remedies and the ready availability of plant resources [4]. However, the consumption of certain medicinal plants during

pregnancy or breastfeeding may lead to serious adverse effects, such as uterine contractions, spontaneous abortions, fetal abnormalities, or interactions with prescribed medications such as oxytocin [5,6]. Moreover, the widespread misperception of the harmlessness of natural products represents a significant risk factor, especially when these products are used without professional supervision [7].

In the province of Taza, a rural area in northeastern Morocco, the use of medicinal plants to induce labor remains a common practice, particularly in traditional settings. Cases of uterine rupture have been reported in this region, suspected to be associated with interactions between certain plants and oxytocin administered in hospital settings. The aim of this study is to document these practices by identifying the most commonly used plant species, their modes of preparation, routes of administration, and associated complications. It also seeks to assess the frequency of these practices among breastfeeding women who have previously used such plants during pregnancy, as well as among currently pregnant women who intend to use them. Ultimately, this study aims to raise awareness among healthcare professionals about the potential risks and to improve obstetric care.

MATERIALS AND METHODS

➢ Study Area

The study was conducted in the northeastern region of Morocco, specifically in the province of Taza (**Figure 1**), which belongs to the administrative region of Fès-Meknès. The study area extends mainly to the north of the city of Taza and encompasses a group of rural municipalities crossed by several secondary and national roads, including the N29, N6, the A2 highway, as well as the R508, P5416, P5418, and P5421 roads.

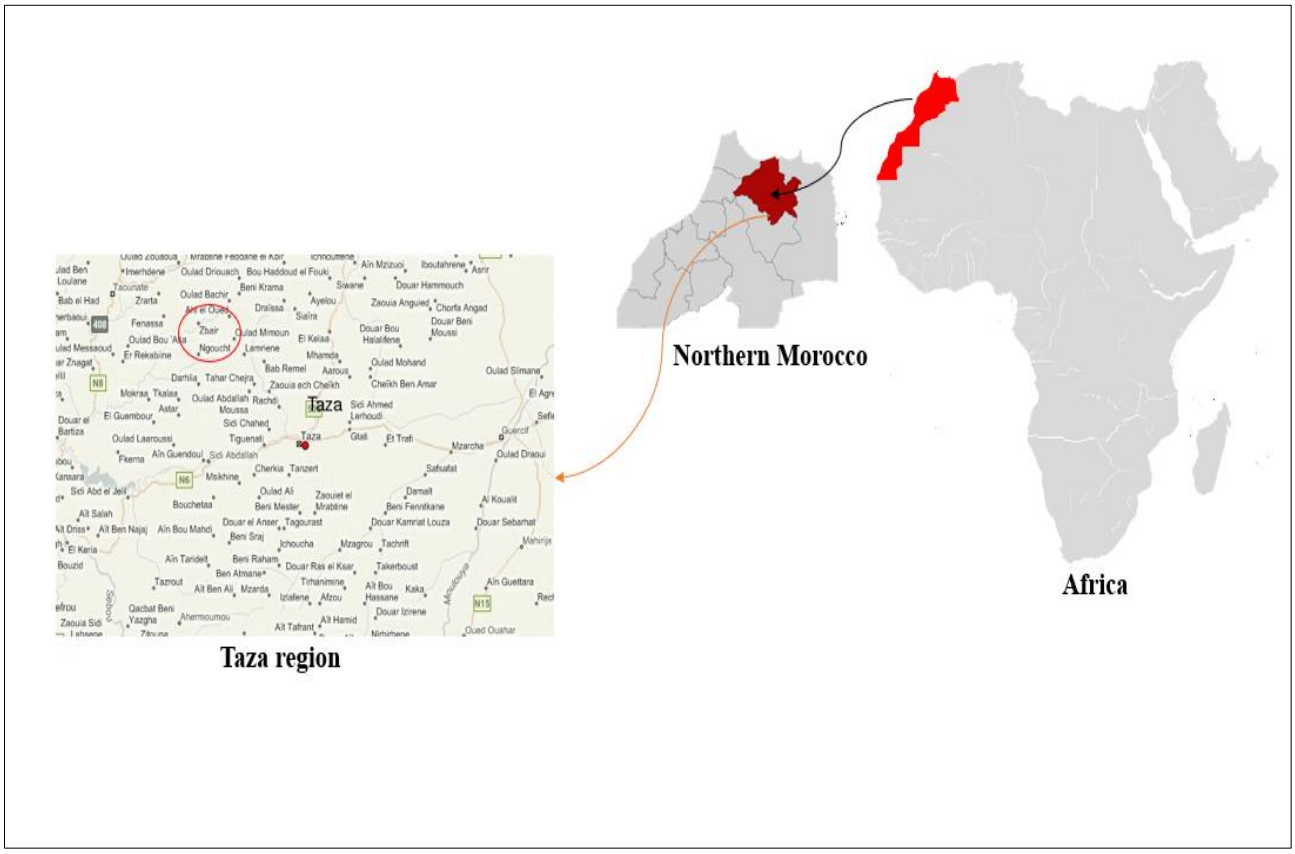

Figure 1: Location of the research site in the Taza Province (Fès-Meknès region, Morocco) [15]

The figure below shows the geographic location of the research site, situated in Taza Province in northeastern Morocco. This area is mainly composed of rural municipalities and is served by several road networks, including National Road N29, Highway A2, and regional roads such as R508, P5416, and P5418.

This region is characterized by a mountainous and hilly landscape, with limited accessibility, particularly in remote douars (villages). The territory includes several rural localities such as Centre Commune Bni Lent, Souk El Had des Ouled Zbair, Tnine R'bee Lfouki, Sebt Bni Frassen, and Ouled Aziz, among others. The city of Taza represents the main urban hub, providing reference health services and infrastructure for the surrounding rural population.

➢ Study Population

The survey was conducted in the rural province of Taza, a region characterized by low-income levels and a predominantly illiterate population. This area is rich in

biodiversity and has a long-standing phytotherapeutic tradition. Commonly used medicinal plants include *Rosmarinus officinalis L.* (Lamiaceae), *Thymus vulgaris L.* (Lamiaceae), *Mentha pulegium L.* (Lamiaceae), *Artemisia absinthium L.* (Asteraceae), and *Rubus idaeus L.* (Rosaceae) [8,9].

➢ Data Collection

Data were collected between April and November 2024 using a structured questionnaire administered in provincial health centers by midwives. The inclusion criteria were pregnant and breastfeeding women who consented to participate in the survey. The questionnaire (see Appendix) explored sociodemographic characteristics, the use of medicinal plants, methods of preparation, sources of information, medical supervision, and awareness of associated risks.

➢ Statistical Analysis

Data were analyzed using SPSS version 21. Qualitative variables were expressed as percentages, and quantitative variables as means ± standard deviation. The Chi-square test was used to examine the association between educational level and the use of medicinal plants, while Spearman's correlation was applied to assess the relationship with age. A p-value < 0.05 was considered statistically significant.

➢ Ethical Considerations

Informed consent was obtained from all participants. Anonymity and confidentiality of data were strictly maintained throughout the study.

RESULTS

➢ Sociodemographic Data

A total of 102 women were included in the study, consisting of breastfeeding women (66.7%) and pregnant women (33.3%). The majority of participants were housewives (87.3%), followed by merchants (5.6%), civil servants (4.0%), and students (2.9%). With regard to age distribution, most participants were between 18 and 36 years old, with a mean age of 31.03 ± 8 years.

In terms of education, more than half of the women (53.9%) had a primary school level, 29.4% had no formal education, 15.7% had reached secondary school, and only 1% had a university level. The most frequent reasons for hospitalization or medical consultation at the time of the survey were postnatal visits (64.7%) and child vaccination (31.4%). Prenatal consultations accounted for 2.9% of cases, while ongoing childbirth represented only a minority (1%) (**Table 1**).

Table 1: Sociodemographic and clinical characteristics of the respondents

Parameters	**%**
Status	
Breastfeeding	66.7
Pregnant	33.3
Occupation	
Housewife	87.3
Trader	5.6
Civil servant	4.0
Student	2.9
Age group (years)	
[18–24]	27.0
(24–30]	24.0
(30–36]	22.0
(36–42]	18.0
(42–48]	8.0
(48–52]	1.0
Educational level	
Primary	53.9
Illiterate	29.4
Secondary	15.7
University	1.0
Reason for hospitalization / consultation	
Postnatal consultation	64.7
Child vaccination	31.4
Prenatal consultation	2.9
Delivery	1.0

➢ **Use of Medicinal Plants Among Pregnant Women to Induce Labor:**

Among the 102 women surveyed, 38 (37.25%) reported using medicinal plants with the intention of inducing labor. Analysis of the responses identified 58 instances of plant use, corresponding to 38 distinct recipes that included various species, plant parts, methods of preparation, and routes of administration.

The most frequently reported plant was. Presl (Qerfa – cinnamon), mentioned in 25 cases (65.8% of users). It was primarily consumed as an infusion or decoction of bark, either alone or in combination with other plants. The second most commonly reported species was *Thymus vulgaris L.* (Zaâtar – thyme), cited in 14 cases, followed by *Matricaria chamomilla L.* (Babounj – chamomile) and *Trigonella foenum-graecum L.* (Halba – fenugreek), each mentioned four times. Oil extracted from the fruits of *Olea europaea* L. (olive) was used three times. Other plants, including *Rosmarinus officinalis L.* (rosemary), *Salvia officinalis L.* (sage), *Coffea arabica L.* (coffee), *Rubus idaeus* L. (raspberry), and *Syzygium aromaticum* (L.) Merr. & L.M. Perry (clove), were reported less frequently (1–2 uses each).

The most commonly used plant parts were leaves (thyme, sage, rosemary, raspberry, clove) and bark or seeds, depending on the plant species (**Table 2**).

Table 2: Medicinal plants used by 38 women to induce labor

Scientific name (author)	Local vernacular name	French name	Plant part used	Quantity (teaspoon)	Number of uses (N = 38)
Cinnamomum verum J. Presl	Qerfa	Cinnamon	Inner bark	More than 1	25
Thymus vulgaris L.	Zaâtar	Thyme	Leaves and flowering tops	More than 1	14
Matricaria chamomilla L.	Babounj / Qamomila	Chamomile	Flower heads	Variable (1/4 to 1/2)	4
Trigonella foenum-graecum L.	Halba	Fenugreek	Seed	More than 1	4
Olea europaea L.	Zitoun	Olive	Fruit oil	More than 1	3
Rosmarinus officinalis L.	Azîrr	Rosemary	Leaf	More than 1	2
Salvia officinalis L.	Al-Sâlmiya	Sage	Leaf / Flowering tops	1	2
Coffea arabica L.	Qhwa	Coffee	Seed (powder)	More than 1	2
Rubus idaeus L.	Tut al-aliq	Raspberry	Leaf	1	1
Syzygium aromaticum (L.) Merr. & L.M. Perry	Qronfol / Masmar l-khzan	Clove	Dried flower buds	More than 1	1

The most common modes of preparation were infusions (particularly for thyme, chamomile, and cinnamon), followed by decoctions (often involving mixtures that included cinnamon, fenugreek, or coffee) and cold macerations (mainly for fenugreek). Some recipes combined multiple plants, such as cinnamon–thyme–sage or cinnamon–chamomile mixtures.

In addition, uterine massages were reported, using mixtures of ground coffee, olive oil, and cinnamon, or sage with olive oil (**Table 3**). These remedies were predominantly administered orally; however, four recipes were applied topically in the form of abdominal massages, which were perceived as facilitating contractions.

Table 3: Medicinal plants used, preparation methods, routes of administration, and frequency of use for labor induction

Preparation Method	Plant(s) Used (Form)	Route of Administration	Number of Observations
Infusion	*Cinnamomum verum J.Presl* (cinnamon, powder)	Oral	10
	Thymus vulgaris L. (thyme, dried leaves)	Oral	4
	Cinnamomum verum J.Presl + *Trigonella foenum-graecum L.* (cinnamon, powder + fenugreek, dried seeds)	Oral	2
	Matricaria chamomilla L. (chamomile, dried flower heads)	Oral	2
	Syzygium aromaticum (clove, dried flower buds) + *Matricaria chamomilla L.* (chamomile, flower heads)	Oral	1
	Cinnamomum verum J.Presl + *Thymus vulgaris L.* + *Salvia officinalis L.* (cinnamon + thyme + sage, dried leaves)	Oral	1

Preparation Method	Plant(s) Used (Form)	Route of Administration	Number of Observations
Decoction	*Cinnamomum verum J.Presl* + *Thymus vulgaris L.* (cinnamon, powder + thyme, dried leaves)	Oral	7
	Cinnamomum verum J.Presl + *Rosmarinus officinalis L.* (cinnamon + rosemary, dried leaves)	Oral	1
	Matricaria chamomilla L. + *Cinnamomum verum J.Presl* (chamomile flower heads + cinnamon powder)	Oral	1
	Thymus vulgaris L. + *Rosmarinus officinalis L.* (thyme + rosemary, dried leaves)	Oral	1
	Cinnamomum verum J.Presl + *Coffea arabica L.* (cinnamon + coffee, powder)	Oral	1
	Rubus idaeus L. (raspberry, dried leaves)	Oral	1
Cold Maceration	*Trigonella foenum-graecum L.* (fenugreek, dried seeds)	Oral	2
Abdominal Massage	*Olea europaea L.* (olive, oil)	Topical (abdominal massage)	1
	Coffea arabica L. + *Cinnamomum verum J.Presl* + *Thymus vulgaris L.* (coffee + cinnamon + thyme, crushed)	Topical (abdominal massage)	1
	Olea europaea L. + Cinnamomum verum J.Presl (olive oil + cinnamon)	Topical (abdominal massage)	1
	Salvia officinalis L. + *Olea europaea* L. (sage leaves + olive oil)	Topical (abdominal massage)	1
Total			38

➢ **Reported Complications**

Several complications were reported by women who declared having used medicinal plants to induce labor, mainly when consumed during the third trimester of pregnancy. These adverse effects were based solely on the testimonies of the participants and were not supported by medical confirmation or causality assessment (**Table 4**).

Table 4: Complications associated with medicinal plant use

Plant Combination Used	Number of Reported Cases	Effect Observed According to Participants	Notes
Cinnamomum verum J.Presl + *Thymus vulgaris L.* + *Salvia officinalis L.*	1	Uterine hemorrhage	Reported by one participant; no formal causal relationship established
Cinnamomum verum J.Presl + *Thymus vulgaris L.*	2	Intense and painful uterine contractions	No confirmed obstetric complications
Cinnamomum verum J.Presl + *Matricaria chamomilla L.*	1	Abrupt acceleration of labor	Perceived as abnormal by the participant
Cinnamomum verum J.Presl + *Trigonella foenum-graecum L.*	2	Spontaneous abortion	Reported by two participants; no medical confirmation
Trigonella foenum-graecum L. alone	1	Spontaneous abortion	Reported by one participant; no pharmacovigilance assessment conducted

One case of uterine hemorrhage was reported following the consumption of a mixture of cinnamon, thyme, and sage. Two additional women who had used cinnamon in combination with thyme described experiencing particularly intense and painful uterine contractions, although no obstetric complications were clinically confirmed. Another case involving the combined use of cinnamon and chamomile was associated with a sudden acceleration of labor, perceived as abnormal by the patient.

More concerning, two women reported spontaneous abortions after taking cinnamon with fenugreek, while a third case of miscarriage was reported following the consumption of fenugreek alone.

It is important to emphasize that these reports were collected during the survey, and no formal causal relationship has been established. No pharmacovigilance or imputability assessment was conducted to confirm these associations.

➢ **Sources of Information, Medical Supervision, and Perception of Risks and Efficacy**

Analysis of the responses highlighted a predominantly informal transmission of knowledge regarding phytotherapy. In 94.3% of cases, participants

reported that their primary source of information was family or social contacts, compared to only 5.7% who cited the Internet. Regarding modes of procurement, medicinal plants were mainly obtained from grocers (39.6%), grown near the home (30.2%), or purchased from herbalists (17%). In 13.2% of cases, women combined multiple sources of supply.

The use of these plants was carried out almost systematically without medical supervision: 94.3% of users had not consulted a healthcare professional prior to use. Distance from healthcare facilities was cited as the main explanatory factor (83%), followed by positive experiences reported by other women (17%). All physicians interviewed in the study expressed their disapproval of this practice (100%).

Despite the lack of medical endorsement, the perceived efficacy of medicinal plants remained high: 60.38% of women considered them very effective, and 37.74% considered them effective.

Finally, awareness of the risks associated with plant use was low. None of the participants knew the potential risks related to labor induction, and 92.45% were unaware of which plants were contraindicated during pregnancy. Among the few women who could name a contraindicated plant, fenugreek was cited in 100% of cases.

➢ **Statistical Analysis: Educational Level and Use of Plant-Based Remedies to Induce Labor (Figure 2)**

Out of a total of 102 participants, 38 reported using medicinal plants to induce labor. Among illiterate women, 21 (55%) reported having used plant-based remedies, compared to 16 (42%) of women with a primary education level. Only one woman with a secondary education reported such use, and none of the women with a university-level education reported it (Figure 2).

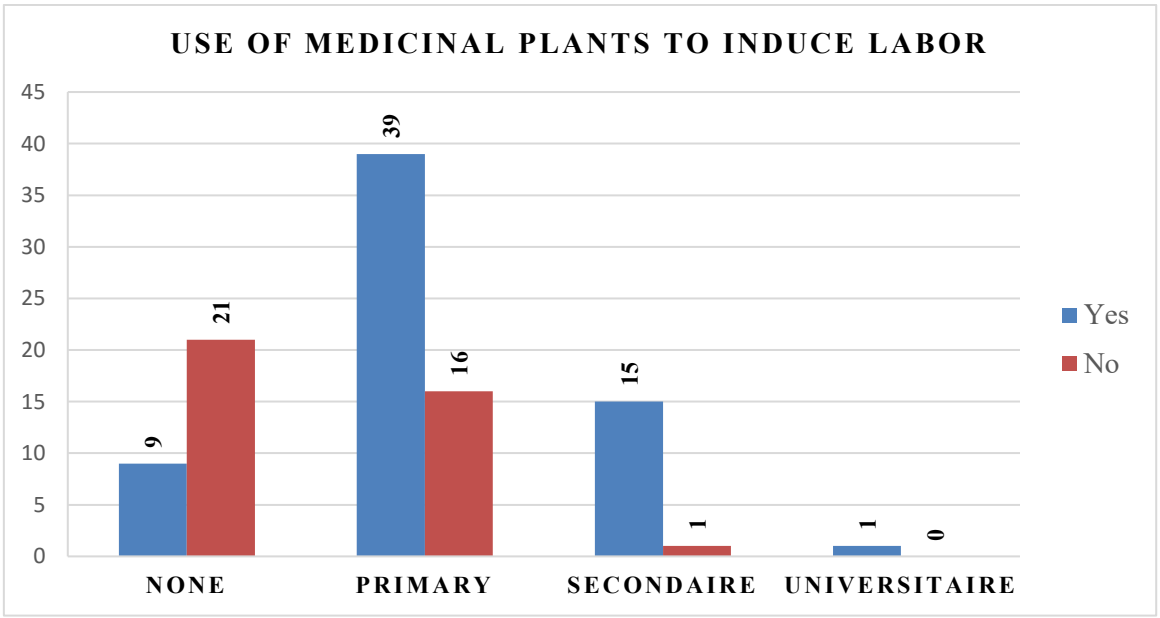

Figure 2: Educational level of the participants and the use of medicinal plants to induce labor

Cross-tabulation analysis between educational level and the use of plant-based remedies to induce labor yielded the following results: Pearson's Chi-square = 22.503, degrees of freedom = 3, $p < 0.001$. Measures of association intensity were Phi = 0.470 and Cramer's V = 0.470.

➢ **Participant Age and Use of Plant-Based Remedies**

The correlation between participants' age and the use of medicinal plants was assessed using Spearman's rank correlation test. The results indicated a significant negative correlation between age and the use of plant-based remedies to induce labor (Spearman's Rho = −0.485, $p < 0.001$).

DISCUSSION

Our survey confirms that empirical use of medicinal plants during pregnancy is common in the Taza region, particularly for labor induction. In our series, 37.3% of women reported using phytotherapy to accelerate labor, consistent with global trends in which traditional medicine is widely practiced [10]. In Africa, a systematic review showed that up to 80% of African women rely on traditional medicine for maternal health, often due to limited access to modern healthcare in rural areas [11]. A Moroccan study in the province of Guelmim reported a 66.96% rate of medicinal plant use among pregnant women [12], reflecting the cultural importance of these practices. Our lower rate may be explained by the fact that we specifically studied plant

use for labor induction rather than overall use during pregnancy.

The plants identified in our survey largely correspond to those cited in regional literature. A recent systematic review reported that *Cinnamomum verum* J. Presl (cinnamon), *Thymus vulgaris* L. (thyme), *Matricaria chamomilla* L. (chamomile), and *Trigonella foenum-graecum* L. (fenugreek) are among the most frequently consumed by pregnant women [13]. Kamel *et al.,* also identified *Thymus maroccanus* Ball (endemic Moroccan thyme) and *Trigonella foenum-graecum* L. as commonly used species for labor induction [12]. The predominance of cinnamon and thyme may be associated with Moroccan phytotherapeutic culture, as Lamiaceae species (thyme, rosemary, sage, etc.) are widely represented in local traditional pharmacopoeia [14].

Preparation methods are typical of popular pharmacopoeias. Infusions were the most common method (e.g., cinnamon or thyme infusion), followed by decoctions (e.g., cinnamon–fenugreek, cinnamon–coffee) and seed macerations (fenugreek). Some complex mixtures, such as cinnamon–thyme–sage or coffee–cinnamon–olive oil used in abdominal massages, were also reported. These practices are consistent with other surveys; for example, Kamel *et al.,* noted frequent use of aromatic decoctions to facilitate labor [12]. The use of uterine massages with olive oil and plants is also documented in Moroccan ethnographies as a method to "stimulate" contractions.

Several users described obstetric complications after consuming these remedies, mainly during the third trimester. Reported effects included uterine hemorrhage, intense painful contractions, precipitated labor, and even spontaneous abortions after cinnamon and/or fenugreek use. Although there is no formal proof of causality (no pharmacovigilance imputability studies), these reports are notable. Literature indicates that some of these plants may have abortifacient or uterotonic effects. For example, fenugreek is known to stimulate the uterus, and high-dose use during pregnancy is not recommended: the US National Center for Complementary and Integrative Health (NCCIH) classifies it as unsafe above dietary amounts due to increased risk of fetal malformations and spontaneous abortion [15]. Other African studies report severe obstetric events linked to plants: in Tanzania, uterine rupture and hemorrhage were noted after local herbal decoctions, although independent plant effects were not always isolatable [16]. These findings support concerns that uncontrolled dosing and lack of knowledge of toxicity profiles make these practices risky.

Plant use is rarely medically supervised. In our survey, 94% of women did not consult any healthcare professional before use. This behavior reflects the common Moroccan pattern of relying on family and social networks: 94.3% of respondents indicated that guidance came from their entourage. Similarly, a Moroccan study on diabetes showed that 77% of patients used plants based on positive experiences of others [14]. This reliance on popular experience also explains the perception of "safety": in another survey, 91.4% of women considered medicinal plants "safe" [17]. In our population, however, knowledge of risks was strikingly low: 92% were unaware of which plants are contraindicated in pregnancy, and only a few mentioned fenugreeks. This knowledge gap is corroborated by Zeggwagh *et al.,* in Fès, where only 12% of patients could identify toxic plants [14].

Statistical analyses highlight associations with low education level and age. Illiterate women reported the highest use (55%), whereas no university graduates reported plant use—a highly significant association ($Chi^2 = 22.503$; $p < 0.001$). Spearman correlation ($rho = -0.485$, $p < 0.001$) indicated that younger women were more likely to use plants to induce labor. This sociodemographic profile aligns with other African studies: Shewamene *et al.,* reported that primary users of traditional maternal medicine were often poorly educated, low-income, and living far from healthcare centers [11]. Similarly, the scoping review by Adamolekun *et al.,* identified academic education and low socioeconomic status as frequent determinants of plant use during pregnancy [18].

Overall, these findings confirm the major role of phytotherapy in maternal care in Morocco and Africa but highlight the gap between trust in these remedies and knowledge of their risks. Healthcare professionals should be aware that many women use decoctions of *Cinnamomum verum* J. Presl, *Thymus vulgaris* L., etc., often without spontaneously reporting them. It is therefore crucial to systematically inquire about traditional remedies during prenatal and postnatal consultations. The high perceived efficacy (60% of our respondents rated them "very effective") underscores the need for rigorous information on potential contraindications. At the public health level, these results emphasize the need for awareness programs targeting midwives and rural populations on the potential dangers of certain plants during pregnancy. Finally, these observations support further research: targeted pharmacovigilance on obstetric complications related to phytotherapy could objectively assess risks and guide future recommendations.

CONCLUSION

The study conducted in the Taza province demonstrates that the use of medicinal plants for labor induction is a widespread and culturally entrenched practice. Preparations based on *Cinnamomum verum* J. Presl (cinnamon) and *Thymus vulgaris* L. (thyme) were the most frequently used, often administered as infusions or decoctions, and primarily recommended by family members without medical supervision. Reported complications including uterine hemorrhage, intense contractions, precipitated labor, and a few cases of

spontaneous abortion raise clinical concerns, especially since most reports were not confirmed through formal pharmacovigilance or imputability studies. Analyses show that usage is significantly associated with low educational level and decreases with higher education. These findings highlight an urgent need for targeted information and awareness campaigns, systematic inquiry about traditional practices during prenatal consultations, and further research (pharmacology, safety, and pharmacovigilance) to objectively assess the risks associated with these plants. Overall, it is imperative to integrate an educational and public health approach that respects traditional knowledge while safeguarding maternal and perinatal health. jrf

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APPENDIX

This questionnaire is anonymous. Participants are free to take part or not to take part in the study.

1. **Age :** …… ……
2. **Educational level :**
   ☐ No formal education ☐ Primary ☐ Secondary ☐ University
3. **Occupation :** ……
4. **Reason for hospitalization/consultation :**
   ……
5. **You are :**
   ☐ Pregnant
   ☐ Breastfeeding

6. **Have you ever used medicinal plant(s) to induce labor?**

☐ No

☐ Yes → If yes, please describe the plant(s):

……...……

a. Which part of the plant did you use? (e.g., root, leaf, flower, fruit, etc.)

……..

b. How many spoonfuls of the plant part did you take?

☐ One quarter (1/4) ☐ One third (1/3) ☐ One half (1/2) ☐ One spoonful ☐ More than one spoonful

c. Preparation: ……

d. Route of administration: ……

7. **How did you obtain information about the benefits of the plant(s) you used?**

☐Media (TV, radio, etc.)

☐ Internet

☐ Relatives/friends

☐ Healthcare professionals

☐ Other: ……

8. **How did you obtain the plant(s)?**

☐ Herbalist

☐ Grocer

☐ Other : ……

9. **Did you consult a healthcare professional before using these plants?**

☐ Yes ☐No → If no, why did you decide not to consult a healthcare professional?

……

10. **Did your physician approve this practice?**

☐ Yes ☐ No

11. **How do you assess the effectiveness of the plant-based treatment you used to induce labor?**

☐ Very effective ☐ Effective ☐ Not effective

12. **Did you experience any complications or adverse effects following the use of these plants?**

☐ No

☐ Yes, please specify: ……

13. **Are you aware of the risks associated with the use of these plants to induce labor?**

☐ No ☐ Yes

14. **Do you know of any plants that are contraindicated in your condition?**

☐ No

☐ Yes, please specify: ……