

Traditional Neonatal Medicine in Laâyoune (Southern Morocco): Practices, Complications and Public Health Implications

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Abstract

Case Report

Context: The neonatal period is a critical phase during which the newborn is particularly vulnerable to infections and metabolic disturbances. In Morocco, traditional medicine remains deeply rooted in popular culture and significantly influences newborn care. While some practices have cultural or symbolic value, others expose the infant to serious infectious, toxic, or metabolic risks. No data specific to the Saharan region of southern Morocco are available in the literature. **Objective:** To describe traditional neonatal medicine practices in Laâyoune, to assess their impact on the health of the newborn and to formulate public health recommendations adapted to the local cultural context. **Methods:** A descriptive cross-sectional study was conducted among 100 mothers of newborns at the Moulay El Hassan Ben El Mehdi Regional Hospital Center in Laâyoune. Data were collected through face-to-face structured questionnaires and direct clinical observation, covering sociodemographic characteristics, types of traditional practices, their motivations, and observed adverse effects. **Results:** The mean maternal age was 26.4 ± 5.9 years. Half of the mothers had a low level of education (20% illiterate, 30% primary school). The use of traditional medicine was reported by 58% of the mothers, primarily for therapeutic (60%), cultural (52%), or preventive (45%) purposes. The most frequent practices included the application of kohl, massages with cade oil or dhen, oral administration of honey, dates, and herbal teas, and fumigation. Among the users, 32% reported adverse effects: skin irritation (34%), digestive problems (22%), umbilical infections (16%), eye irritation (13%), and respiratory problems (9%). Two neonatal deaths (4%) were recorded: one from methemoglobinemia and hepatic cytolysis after ingestion of "leghdar" water, the other from acute renal failure after ingestion of a mixture of plants prepared by a ferraga. **Conclusion:** Traditional neonatal medicine is widely practiced in Laâyoune and associated with a significant burden of complications, including two deaths directly attributable to traditional preparations. These findings call for strengthening maternal education, training healthcare personnel, and developing a respectful dialogue between modern medicine and traditional knowledge in southern Morocco.

Keywords: Traditional medicine; neonatal care; newborn; complications; kohl; ferraga; Morocco; Laâyoune; Saharan region; public health.

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1. INTRODUCTION

The neonatal period, defined as the first 28 days of life, represents the most vulnerable phase of human existence. Globally, approximately 2.4 million neonatal deaths occur each year, the vast majority in low- and middle-income countries [1]. In Morocco, despite progress in perinatal care, neonatal mortality was estimated at 14 per 1,000 live births in 2022 [2], with significant disparities between urban centers and peripheral regions.

The World Health Organization (WHO) defines traditional medicine as the body of knowledge, skills, and practices based on the theories, beliefs, and experiences specific to different cultures [3]. In Africa and North Africa, it remains widely used in neonatal care. In Morocco, ethnobotanical and anthropological studies have documented the persistence of traditional neonatal practices, including the use of kohl, animal fats, medicinal plants, and ritual fumigations [4, 5]. These practices are deeply rooted in cultural identity and passed down from generation to generation, often alongside the use of modern healthcare.

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The Laâyoune-Sakia El Hamra region in southern Morocco presents a unique socio-cultural profile. Its population blends settled urban dwellers, semi-nomadic groups, and sub-Saharan migrants, united by a Hassani cultural identity in which the knowledge of traditional healers (ferragas) holds considerable sway. Despite this distinctiveness, no study to date has documented traditional neonatal medicine practices in this region.

The present study aims to describe these practices in Laâyoune, to quantify their prevalence and associated complications, and to propose public health recommendations adapted to the local cultural context.

2. MATERIALS AND METHODS

2.1. Type of study and framework

This is a descriptive cross-sectional study conducted in the Pediatrics – Neonatal Intensive Care Unit of the Moulay El Hassan Ben El Mehdi Regional Hospital Center (CHR) in Laâyoune, the regional referral hospital for the southern provinces of Morocco (Laâyoune-Sakia El Hamra). The city of Laâyoune has approximately 262,791 inhabitants and is the main urban center of a region characterized by a desert climate, marked social heterogeneity, and a deeply rooted Saharan culture.

2.2. Study population and inclusion criteria

The target population included mothers of newborns hospitalized or followed up in the pediatric department. The inclusion criteria were:

- Mother of a live newborn (gestational age ≥ 28 weeks);
- Residing in the Laâyoune region;
- Informed verbal consent obtained after information on the objectives of the study.

Mothers who submitted an incomplete questionnaire or who refused to participate were excluded.

2.3. Sample Size

A total of 100 mothers were consecutively recruited. This sample size was determined to allow for a descriptive estimate of the prevalence of traditional

medicine use with an acceptable margin of error ($\pm 10\%$), given the exploratory nature of the study.

2.4. Data Collection

Data were collected using a structured questionnaire administered face-to-face by trained healthcare professionals during postnatal visits or upon hospital discharge. The questionnaire explored:

- Socio-demographic characteristics (age, level of education, urban or rural residence, health coverage);
- Use of traditional medicine: yes/no, type of practice used, time of use and motivation (therapeutic, cultural or preventive);
- Adverse effects observed: type, severity and presumed responsible practice.

Clinical data (neonatal outcomes, documented complications) were extracted from medical records and validated by direct clinical observation.

2.5. Statistical Analysis

The data were analyzed using SPSS (version 25). Qualitative variables are expressed as frequencies and percentages. Associations between sociodemographic variables (level of education, place of residence) and the use of traditional medicine were assessed using the chi-square (χ^2) test, with a significance threshold set at $p < 0.05$.

2.6. Ethical considerations

The study was conducted in accordance with the Declaration of Helsinki. All participants gave prior informed verbal consent before their inclusion. Anonymity and data confidentiality were strictly maintained throughout the study.

3. RESULTS

3.1. Sociodemographic characteristics

One hundred mothers were included. The mean age was 26.4 ± 5.9 years (range: 18–42 years). Half of the participants had a low level of education: 20% were illiterate and 30% had only completed primary school. Eighty percent of the mothers had health insurance, and 60% lived in urban areas. Sociodemographic characteristics are summarized in Table 1.

Table 1: Sociodemographic characteristics of the 100 mothers included

Characteristic	Result
Total number of mothers included	100
Average age (years)	26.4 ± 5.9 (range: 18–42 years)
Education level: Illiterate	20%
Education level: Primary	30%
Education level: Secondary or higher	50%
Health coverage (RAMED or insurance)	80%
Urban residence	60%
Rural or suburban residence	40%
Use of traditional medicine	58%

3.2. Prevalence and characteristics of the use of traditional medicine

The use of traditional medicine was reported by 58% of mothers for their newborns. The timing of use was distributed as follows: at birth (31%), during the first few days of life (29%), for illness (33%), and after the first week of life (7%). The main stated motivations were therapeutic (60%), cultural (52%), and preventative (45%).

The most frequently reported traditional practices are presented in Table 2. The application of kohl to the eyes and/or navel, body massages with cade oil (ketran) or animal fat (dhen), and the oral administration of honey and dates were among the most widespread practices. Preparations made by traditional healers (ferraga), of varying composition, were also reported.

Table 2: Main traditional neonatal practices reported in the study population

Traditional practice	Time of use	Substance / Modality
Kohl application	From birth	Antimony powder applied to the eyes and/or navel
Body massage	First days	Cade oil (ketran), dhen (animal fat)
Henna application	First days	Henna on the palms, soles of the feet, scalp
Oral administration of substances	Variable	Honey, dates, herbal teas, "leghdir" water
Fumigations / incense (bakhoor)	Variable	Inhalation of aromatic fumes for protective or therapeutic purposes
Traditional umbilical care	From birth	Application of hermel, kohl or plant substances to the cord
Healer's preparations (ferraga)	Variable	Plant mixtures of varying composition prepared by a traditional healer

3.3. Side effects and complications

Of the 58 mothers who used traditional medicine, 32% reported at least one adverse effect in their newborn. The distribution of complications is shown in Table 3.

The most frequent adverse effects were skin irritations or erythema (34%), observed mainly after the application of cade oil, henna, or dhen. Digestive disorders, including vomiting and diarrhea, were reported in 22% of cases, most often following the oral administration of dhen, honey, herbal teas, or dates. Umbilical infections occurred in 16% of cases, related to the application of kohl or hermel to the umbilical stump. Eye irritations occurred in 13% of cases after periorcular

application of kohl, and respiratory problems in 9% following fumigation.

Two neonatal deaths (4% of users, 2% of the total cohort) were recorded in the neonatal intensive care unit. The first case involved a newborn who developed methemoglobinemia associated with hepatic cytolysis (blue baby syndrome) after ingesting "leghdir" water—a traditional preparation containing oxidizing compounds. The second death resulted from acute renal failure after ingesting a complex herbal mixture prepared by a ferraga (traditional healer). Both deaths were directly attributable to toxic exposure related to the traditional preparations.

Table 3: Adverse effects reported in newborns exposed to traditional practices (n=58 users)

Side effect	Frequency (%)	Associated practice(s)
Skin irritations/erythema	34%	Cade oil (qitran), henna, dhen
Digestive problems (vomiting, diarrhea)	22%	Dhen, honey, herbal teas, dates
Umbilical infections	16%	Kohl or hermel applied to the umbilical cord
Eye irritations	13%	Kohl applied around the eyes
Respiratory problems	9%	Fumigations, incense (bakhoor)
Neonatal death	4% (n=2)	Water from "leghdir" (methemoglobinemia + liver cytolysis); mixture of plants — ferraga (acute renal failure)

3.4. Factors associated with the use of traditional medicine

Low maternal education and rural residence were significantly associated with greater use of traditional medicine ($p < 0.05$). Illiterate mothers or those with only a primary education used traditional practices significantly more often than those with a secondary or higher education. No significant association was found between health coverage and the use of traditional medicine.

4. DISCUSSION

4.1. Prevalence of traditional neonatal practices in the Saharan context

Our study found that 58% of mothers in Laâyoune used traditional medicine, a prevalence consistent with data from other regions of Morocco and sub-Saharan Africa. A 2019 systematic review including 20 studies and more than 11,000 African women reported that up to 80% of mothers use traditional practices in maternal and neonatal care [6]. In Morocco, studies conducted in Marrakech and Casablanca reported

prevalence rates ranging from 50% to 75% [4, 5]. The figure observed in our series therefore falls within this range and reflects a strong cultural connection, although slightly lower than the highest estimates in the literature.

The Saharan cultural context of Laâyoune lends a notable specificity to these practices. The Hassani identity, shared by the region's sedentary, semi-nomadic, and migrant communities, attributes high symbolic authority to the ancestral knowledge of the healers (ferragas). Practices such as the application of kohl and fumigation (bakhour) carry a strong protective significance that transcends their purely therapeutic dimension, rendering inadequate any public health approach limited to biomedical prohibition without cultural dialogue [7].

4.2. Skin, digestive and ocular complications

Skin irritations and erythema were the most frequent complications (34%), mainly related to cade oil (qitran) and animal fat (dhen). Cade oil, obtained by distilling the wood of *Juniperus oxycedrus*, contains high concentrations of phenolic compounds and polycyclic aromatic hydrocarbons with documented dermatotoxic properties [8]. Its application to neonatal skin, whose epidermal barrier is immature, promotes percutaneous absorption and potential systemic toxicity.

Digestive complications (22%) followed the ingestion of honey, dates, herbal teas, and animal fat. Administering honey to newborns exposes them to a risk of infant botulism through contamination with *Clostridium botulinum* spores—a risk that persists even with commercially produced honey [9]. Herbal teas, whose composition is often unknown or variable, may contain alkaloids, tannins, or other bioactive compounds that interfere with neonatal hepatic metabolism.

Umbilical infections (16%) and eye irritations (13%) were directly linked to the application of kohl. Kohl is a preparation based on antimony sulfide (Sb_2S_3) widely used in North Africa and the Middle East, which may contain lead, arsenic, and other heavy metals at concentrations exceeding WHO safety thresholds for children [10]. Its application to the eyes exposes the patient to risks of conjunctivitis, corneal abrasion, and systemic lead absorption; its application to the umbilical cord constitutes a direct entry point for infection, promoting omphalitis and potentially neonatal tetanus [11].

4.3. Serious complications: two neonatal deaths

The most serious finding of our study is the occurrence of two neonatal deaths directly attributable to traditional preparations. These cases warrant detailed discussion as they illustrate the lethal potential of certain practice.

The first death resulted from the ingestion of "leghdir" water, a traditional preparation whose exact

composition varies but which frequently contains oxidizing agents, fermented plant matter, and mineral compounds. The clinical presentation—methemoglobinemia with hepatic cytolysis—is consistent with exposure to nitrosating or oxidizing compounds. Neonatal methemoglobinemia is a life-threatening emergency in which oxidized hemoglobin loses its oxygen-carrying capacity; without prompt treatment with methylene blue, mortality is high [12]. This case illustrates the particular vulnerability of the newborn, whose fetal hemoglobin is significantly more susceptible to oxidation than adult hemoglobin.

The second death resulted from acute renal failure following ingestion of a plant mixture prepared by a ferraga. Neonatal nephrotoxicity of plant origin has been described in association with plants containing aristolochic acids, oxalate-rich preparations, and various alkaloids [13]. The renal failure in this case likely reflects a combination of direct tubulotoxicity and volume depletion from diarrhea, exacerbated by the physiological immaturity of neonatal renal function.

These two deaths are not isolated cases. A study conducted in Marrakech identified similar cases of toxic neonatal deaths linked to preparations by traditional healers [5], and a Tunisian series reported neonatal deaths attributable to the administration of herbal teas [14]. These converging observations underscore that preparations made by ferragas constitute the highest-risk category among traditional neonatal practices and justify specific preventive measures.

4.4. Determinants of recourse to traditional medicine

Low education levels and rural residence were significantly associated with the use of traditional medicine in our cohort, confirming data from the literature [6, 15]. These associations reflect differential access to health information and the greater persistence of traditional knowledge systems in communities with weak integration into the formal healthcare network. Notably, health coverage was not a significant determinant, suggesting that the decision to use traditional medicine is driven more by cultural than economic factors—an important distinction for the design of preventive interventions.

4.5. Public health implications and recommendations

The results of this study have direct implications for neonatal health policy in southern Morocco:

- Targeted early childhood education: Health education programs should specifically address the risks of applying kohl to the eyes and navel, administering honey to newborns, and using mixtures prepared by ferragas (traditional healers). Messages should be culturally appropriate, ideally delivered in Hassaniya Arabic by trained community health workers, and avoid stigmatizing all traditional practices.

- Training of healthcare staff: the neonatology teams in Laâyoune must receive specific training on the recognition and management of complications related to traditional practices, including methemoglobinemia, nephrotoxicity of plant origin and omphalitis secondary to the application of kohl.
- Dialogue with traditional healers: given the cultural authority of the ferragas, programs of structured dialogue between caregivers and traditional healers — inspired by successful initiatives in sub-Saharan Africa [16] — should be explored to negotiate safer practices and establish pathways for referring sick newborns to care facilities.
- Strengthening neonatal surveillance: a systematic registry of neonatal complications potentially linked to traditional practices should be established at the regional level in order to improve epidemiological knowledge and guide evidence-based policies.
- Development of national recommendations: The Ministry of Health and Social Protection of Morocco should consider developing national guidelines on traditional neonatal practices, distinguishing between practices with no documented risk, those requiring risk reduction advice, and those that should be actively warned against due to their proven lethality.

4.6. Strengths and limitations

The main strength of this study is its originality: to our knowledge, it is the first study specifically documenting traditional neonatal practices and their complications in the Saharan region of southern Morocco. The inclusion of direct clinical observation in addition to the questionnaire enhances the reliability of the data collection on complications.

Several limitations must be acknowledged. The cross-sectional design does not allow for the establishment of causal relationships, and the single-center hospital sample may not accurately represent the community as a whole, potentially underestimating the prevalence of practices in non-hospitalized populations. Recall bias may affect maternal reports regarding practices and their temporal relationship to observed complications. Quantitative data on the frequency of each individual practice were not systematically collected. Finally, the composition of traditional preparations, particularly ferragas mixtures, could not be chemically characterized, limiting toxicological analysis.

5. CONCLUSION

Traditional neonatal medicine is widely practiced in Laâyoune, involving 58% of mothers interviewed, and is associated with a significant burden of complications affecting 32% of exposed newborns.

Two neonatal deaths directly attributable to traditional preparations—leghdir water and a ferraga plant mixture—represent the most serious manifestation of a spectrum of risks ranging from skin and eye irritation to life-threatening toxic and metabolic emergencies.

These findings call for an urgent, culturally respectful, and multi-stakeholder response. The goal is not to delegitimize ancestral cultural heritage, but to identify and neutralize practices that expose newborns to avoidable risks. Strengthening maternal education, training healthcare professionals, and engaging in respectful dialogue with traditional healers constitute the three pillars of an effective neonatal protection strategy in southern Morocco.

Multicenter studies in the southern provinces, combined with an ethnobotanical characterization of traditional preparations, are needed to consolidate these results and support the development of evidence-based national recommendations.

Conflicts of interest and financing

The authors declare no conflict of interest. This study received no external funding.

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