

Ethno-Veterinary Survey On The Traditional Use Of Medicinal Plants With Therapeutic Properties In The North-Western Regions Of Tunisia

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Abstract

Ethno-veterinary medicine is a field that focuses on animal health and production. Currently, there is a growing interest in researching how to preserve ancestral practices and optimize their use. Investigations were carried out with individual respondents and focus groups who use aromatic and medicinal plants in regions of north-western Tunisia to gain a better knowledge of its use for animal digestibility treatment. The survey aims to identify demographic details including age, gender, education level and origin of knowledge. Additionally, it intends to identify botanical information of medicinal plants, including families, species, organs, preparation and administration methods and diseases treated. The collected data identified 54 plant species from 37 families. The most significant families were Lamiaceae (24%), Asteraceae (23%), Apiaceae (14%), and Ericaceae (10%). The study areas are rich in spontaneous aromatic and medicinal plants, which are used to treat a variety of animal diseases, especially digestive disorders (26%). Leaves are one of the most commonly used organs (41.7%) for treating animal pathologies. They are typically prepared through decoction (33%) and infusion (24%). In Aindrahim, Nefza, Touiref, and Krib regions, farmers use medicinal plants to treat certain pathologies in their animals. To promote ethnoveterinary medicine, it is important to continue researching sustainable, effective, appropriate, and affordable solutions. The article explores the potential benefits of incorporating *Lavandula stoechas* L., *Ocimum forsskaolii* Benth, *Polypodium vulgare* L. and *Camomille nobile* L. as additives in animal breeding. According to the study, these plants have the ability to enhance animal performance, health and product quality.

Keywords: Ethno-veterinary survey, Medicinal plants, North-west Tunisia

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I. Introduction

Since 2002, the World Health Organization has acknowledged the potential benefits of plant-based therapies in addressing global food insecurity (WHO, 2013). Concomitantly, the Food and Agriculture Organization (FAO) has included ethno-veterinary medicine in its livestock farming development strategies for establishing a sustainable food system. Likewise, the one Health approach promotes collaboration between human and veterinary medicine, as well as environmental sciences. To effectively implement these strategies, a major concern is directed towards the livestock sector, which contributes approximately 12% of total greenhouse gas (GHG) emissions. Its impact on the climate is worsening as global demand for products, particularly animal proteins, is set to increase by 21% between 2020 and 2050 (FAO, 2012). From this perspective, it is important for all countries to work together and take necessary steps towards achieving zero greenhouse gas emissions by 2050. In this sense, traditional veterinary medicine has been a valuable option and has played a significant role in livestock farming, encompassing all aspects from prevention and treatment to disease prevention and promoting healthcare (Baerts et al., 2002; Merazi et al., 2021; Dhifallah et al., 2022).

Semi-arid regions are characterized by low rainfall, diverse ecosystems with a rich variety of plant species and the local cultures have a long tradition of using these plants in many purposes such as veterinary medicine and herbal treatments. Also, Zamin et al. (2024) reported that traditional ethno-botanical use of native, wild, and endemic plant species is a global practice, particularly in economically disadvantaged communities and remote regions. These plants, which are widely documented, showcase their widespread utilization.

The objective of this study is to document the knowledge ethno-veterinary medicine using medicinal plants in semiarid regions of Tunisia. Also, study findings could provide information on medicinal flora to protect their value and provide preservation measures.

II. Material And Methods

Study area

The survey was conducted with the local population of Aindrahim, Nefza, Krib, and Touiref, regions in North-western Tunisia that are rich in natural resources and biological diversity (Fig. 1).

A: Ain Draham is located in the upper humid stage with a temperate winter. It holds the record for the highest average annual precipitation with 1534 mm per year. The average annual temperature is 31.3°C.

B: Nefza has a humid Mediterranean climate with an annual rainfall of 800 to 1200 mm and an average annual temperature of around 31.4°C.

C: ELKrib has a hot and dry Mediterranean climate. The average temperature throughout the year is 29.1°C and the average precipitation is 454.8mm.

D: Touiref also has a hot and dry Mediterranean climate. The average temperature over the year is 18.5°C, and the average precipitation is 627.1mm.

Survey planning

Investigations were carried out with individual respondents and focus groups that use aromatic and medicinal plants in regions of north-western Tunisia to gain a better knowledge of its use for animal digestibility treatment. The survey aims to identify demographic details including age, gender, education level and origin of knowledge. Additionally, it intends to identify botanical information of medicinal plants, including families, species, organs, method of preparation, method of administration and diseases treated (Interview guide). The information that was collected is important for the understanding of the traditional knowledge of ethnoveterinary medicine in the sites that were surveyed (Fig. 1).

Information collection

The intervention model used in the conduct of our survey focuses on the following key stages. We first developed a tentative visit schedule for the four governorates of North-western Tunisia. We contacted 200 relevant individuals to interview, including livestock breeders, forestry technicians, botanists, local associations, and agricultural development groups. We conducted interviews with individual respondents and focus groups in pastures, farms, homes, agricultural development group offices, sales points for aromatic and medicinal plants, and forestry management offices. The diversity of the surveyed individuals allowed us to collect more information than what was mentioned in the interview guide.

Data processing

After collecting information through the interview guide, data entry and results processing were analyzed.

III. Results

The results obtained in the afore mentioned regions in the Northwest have shown that traditional ethno-veterinary practices are largely used for the treatment of pathologies, particularly those related to livestock digestibility. Amazingly, the surveyed regions are also rich in plant diversity, including medicinal and aromatic plants (Fig. 1).



Figure-1 : I : Map of study areas (North-western of Tunisia), **A :** region of Ain Draham (Governorate of Jendouba) ; **B :** region of Nefza (Governorate of Beja) ; **C :** region of ELKrib (Governorate of Siliana) and **D :** region of Touiref (Governorate of Kef). **II :** Plant diversity sites in the study regions

Distribution of survey respondents by age groups and gender

The survey results indicate that most respondents were of an older age, with 29.3% aged between 55 and 65 and 24.1% over 65. A smaller percentage of young people under 35, accounting for 9.4%, participated in the survey (Fig. 2). Also, results indicate that 59% of the respondents were women and 41% were men in terms of gender distribution.

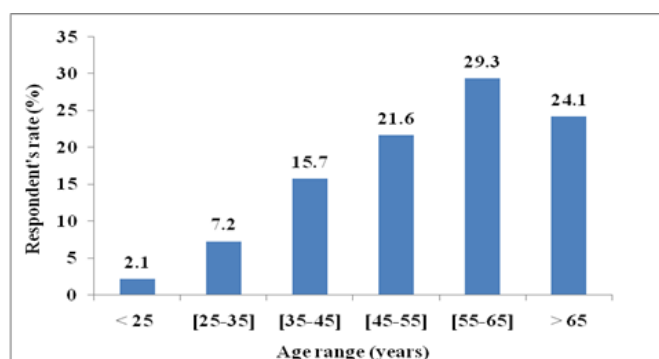


Figure-2: Distribution of survey respondents by age groups in the four study areas of North-western Tunisia.

Distribution of respondents by level of education and legal status

As for the level of education, most of the population surveyed about the use of medicinal plants was uneducated (47%), followed by respondents with a university degree (20%). Additionally, 19% had primary education, while 14% had only secondary education (Fig. 3). The distribution by legal status is also included in the survey results. Of the respondents, 58% were self-employed people, while the remaining 42% were professionals in organizations such as agricultural development groups, mutual agricultural service companies, and economic interest groups.

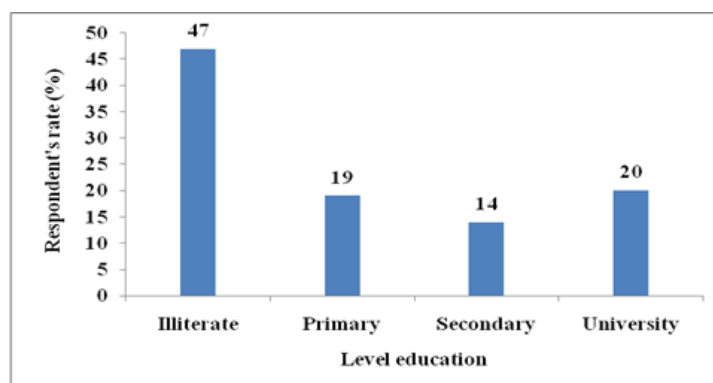


Figure-3: Distribution of survey respondents by level education in the four study areas of North-western Tunisia.**Medicinal plants: information source and users**

According to the respondents, the use of medicinal plants is primarily based on inheritance (57%), followed by social networks and personal initiation (18% and 11%, respectively). The remaining percentage is attributed to training activities (9%) and extension (5%) (Table-1). The use of medicinal plants by profession, showed that the breeders accounting for 66% of respondents. The remaining individuals were distributed among various professions, including promoters of aromatic plant distillation (21%), foresters (6%) who work as advisors or caretakers in forest management, and specialist trainers and veterinarians (5% and 2%, respectively), as shown in (Table-1).

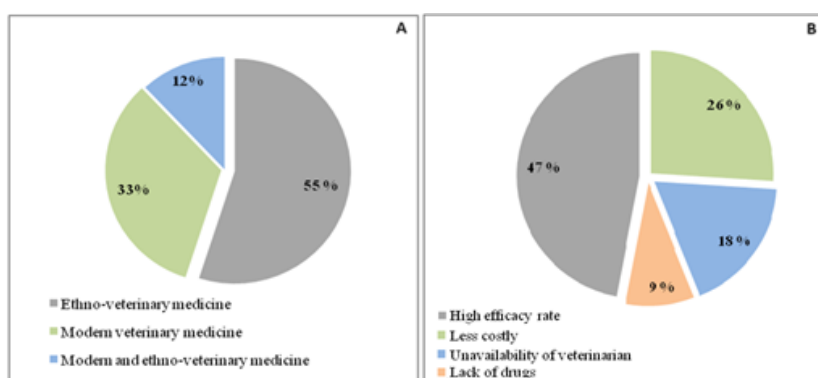
Table-1: Respondent's rate about the information source and users of medicinal plants in the four study areas of North-western Tunisia.

Source information	Respondent's rate (%)	Users distribution by profession	Respondent's rate (%)
Farming advice	5	Breeder	66
Training	9	Developer	21
Personal initiative	11	Forester	6
Heritage	57	Trainer	5
Social networking	18	Veterinarian	2

Why is ethno-veterinary medicine preferred?

The frequency of use of ethno-veterinary medicine in treatment of livestock pathologies in the four regions surveyed is as follows: a majority of 55% of livestock farmers reported using ethno veterinary medicine, while 33% opted for modern veterinary medicine, and 12% used both ethno veterinary and modern therapeutic practices (Fig. 4A).

In the other hand, the investigation revealed that respondents primarily used aromatic and medicinal plants due to their high efficacy rate (47%) and lower cost (26%). Other important reasons included the unavailability of veterinarians and treatment drugs (18% and 9%, respectively) (Fig. 4B). All of these results demonstrate the breeder's commitment to preserving their livestock.

**Figure-4 :** Respondent's rate about (A) : the use ethno-veterinary medicine and (B): the reasons for the use of ethno-veterinary medicine in the four study areas of North-western Tunisia.**Inventory of medicinal plants**

The survey identified various species of medicinal plants listed in Table 2 that were used for disease treatment and as food for animals. The species were identified by the botanist Pr. Marouani Ahmed, Higher School of Agriculture of Kef (ESAK, Tunisia).

Table 2: Respondent's rate about the medicinal plants and their corresponding treatments in the four study areas of North-western Tunisia.

Species	Botanical families	Arabic name	Biological forms	Diseases treated	Respondent's rate (%)
<i>Ajuga iva</i>	Lamiaceae	شندقورة	Herbaceous	Treatment of diarrhea problems and used as an antiseptic	4.3
<i>Allium sativum</i>	Liliaceae	الثوم	Bulbous Pante	Strengthening poultry immunity	17.3
<i>Crinum purpurascens</i>	Amaryllidaceae	البيروس	Herbaceous	Acute bronchitis	2.6
<i>Aloe vera L. Burm.f</i>	Asphodelaceae	الصبار	Shrub	Boosting animals' immune systems	9.3
<i>Echium vulgare L.</i>	Boraginacea	لسان الثور	Herbaceous	Honey plant	6.4
<i>Arbutus unedo L.</i>	Ericacea	البنج	Shrub	Honey plant rich in nectar for bees	11.9

<i>Artemisia absinthium L.</i>	Asteraceae	ست مريم	Perennial shrub	Treatment of weathering	6.4
<i>Asphodelus L.</i>	Liliaceae	البرواق	Perennial herb	Honey plant	3.0
<i>Azolla caroliniana</i>	Salviniaceae	أزوال	Water fern	Animal feed	1.2
<i>Cerantonia siliqua L.</i>	Fabaceae	الخروب	Tree	Animal feed and honey plant	9.0
<i>Chamaemelum nobile L.</i>	Asteraceae	البابونج	Herbaceous	Treatment of digestive disorders	31.4
<i>Cirsium arvense (L.) Scopoli</i>	Asteraceae	البوحالية	Herbaceous	Animal feed and improving milk production	22.6
<i>Cistus creticus L.</i>	Cistaceae	العصاصة	Shrub	Improves intestinal inflammation and boosts the immune system	3.0
<i>Coriandrum sativum L.</i>	Apiaceae	الثبل	Herbaceous	Elimination of gas and treatment of digestive problems	9.2

<i>upressus sempervirens</i>	Cupressaceae	السرول	Tree	Improved immunity in animals	11.7
<i>Dittrichia viscosa L.</i>	Asteraceae	المرزينة	Shrub	Treatment of digestive disorders	4.3
<i>Drimia maritima (L.)</i>	Asparagaceae	الغصن/الفرعون	Herbaceous	Improving the immune system	14.6
<i>Ecballium elaterium</i>	Curcubutaceae	فقوس الحمير	Herbaceous	Treatment of liver problems and scabies	9.6
<i>Echinops ritro L.</i>	Asteraceae	التاسكرا	Perennial herb	Honey dish	6.0
<i>Erica arborea L.</i>	Ericaceae	بوحداد	Shrub	Honey plant	13.2
<i>Erica cinerea L.</i>	Ericaceae	الخلنج	Shrub	Honey plant for bees	1.7
<i>Eruca vesicaria L.</i>	Brassicaceae	الجرجير	Herbaceous	Facilitates delivery in animals	1.7
<i>Eucalyptus obliqua</i>	Myrtaceae	الكالتوس	Tree	Treatment diseases Bronchitis and Honey plant	20.4
<i>Euphorbia characias L.</i>	Euphorbiaceae	تاناغوتة	Shrub	Facilitates intestinal evacuation	5.3
<i>Globularia L.</i>	Plantaginaceae	السلغة	under- shrubs	Utilization antiseptic	6.0
<i>Globularia bisnagarica L.</i>	Globulariaceae	الزريقة	shrub	Treatment of diarrhea	9.0
<i>Pistacia lentiscus L.</i>	Anacardiaceae	الذرو	Shrub	Digestive disorder feed for small ruminants	11.6
<i>Juniperus communis L.</i>	Cupressaceae	العرعار	Shrub	Treatment of digestive disorders	8.4
<i>Lavandula stoechas L.</i>	Lamiaceae	الحلحالة	Shrubs	Digestibility	58.0
<i>Lithospermum L.</i>	Boraginaceae	الملية	Herbaceous	Treatment of conjunctivitis and lameness	4.2
<i>Mentha pulegium L.</i>	Lamiaceae	القليو	Herbaceous	Treatment of varroa in bees	11.0
<i>Myrtus communis L.</i>	Myrtaceae	الريحان	shrub	Digestive disorders and animal feed	11.2
<i>Nerium oleander L.</i>	Apocynaceae	الدقلة	Shrub	Scabies treatment	5.3
<i>Nicotiana tabacum</i>	Solanaceae	دخان	Shrub	Conjunctivitis	6.8
<i>Ocimum forsskaolii Benth</i>	Lamiaceae	الضيمران	Herbaceous	Digestibility	47.6
<i>Olea europaea L.</i>	Oleaceae	الزيتون الجالي	Tree	Digestibility and animal feed (rich in fiber)	7.0
<i>Petroselinum crispum Mill.</i>	Petroselinum	المعدنوس	Herbaceous	Digestive disorders (constipation)	3.1
<i>Phytolacca L.</i>	Phytolaccaceae	السبعة	Shrub	Digestive disorders	27.0
<i>Pinus L.</i>	Pinaceae	الصنوبر	Tree	Intestinal inflammation and wound healing	8.4
<i>Polypodium vulgare L.</i>	Polypodiaceae	السرخنس	Fern	Digestive disorders	36.4
<i>Pulicaria dysenterica L.</i>	Asteraceae	العرار	Herbaceous	Treatment of diarrhea	5.2
<i>Quercus L.</i>	Fabaceae	البلوط	Tree	Animal feed	5.4
<i>Retama raetam Forssk.</i>	Fabaceae	الرتم	Shrub	Scabies treatment	4.6
<i>Ruta graveolens L.</i>	Rutaceae	الفجل	Sub-shrubs	Treatment of acute diarrhea and arthrosis	2.0
<i>Salvia rosmarinus Spenn</i>	Lamiaceae	الكليل	Shrubs	Favors digestibility / honey plant for bees	9.6
<i>Senna alexandrina Mill.</i>	Fabaceae	الزراة	Small shrub	Treatment of inflammatory bowel disease	6.1
<i>Sonchus L.</i>	Asteraceae	التيفاف	Herbaceous	Digestibility	7.5
<i>Stipa tenacissima L.</i>	Poaceae	الحلفاء	Perennial herb	Animal feed	3.0
<i>Tamarix L.</i>	Tamaricaceae	الطرفة	Shrub	Foraging by bees	5.0
<i>Teucrium L.</i>	Lamiaceae	الجعدي	Sub-shrubs	Rinderpest treatment	6.0
<i>Thapsia garganica L.</i>	Apiaceae	الدرياس	Herbaceous	Treating joint disorders	2.7
<i>Thymus vulgaris</i>	Lamiaceae	الزعر	Sub-shrubs	Intestinal problems	23.8
<i>Trigonella foenum-graecum</i>	Fabaceae	الحلبة	Herbaceous	Enhances palatability and digestibility	8.2
<i>Urtica dioica L.</i>	Urticaceae	الحريقة	Herbaceous	Treatment of hypocalcemia	7.2

Distribution of medicinal plants according to botanical family

The survey also identified 54 medicinal plant species belonging to 37 botanical families. Notably, the most represented families were Lamiaceae (24%), Asteraceae (23%), Apiaceae (14%) and Ericaceae (10%), as shown in Figure-5.

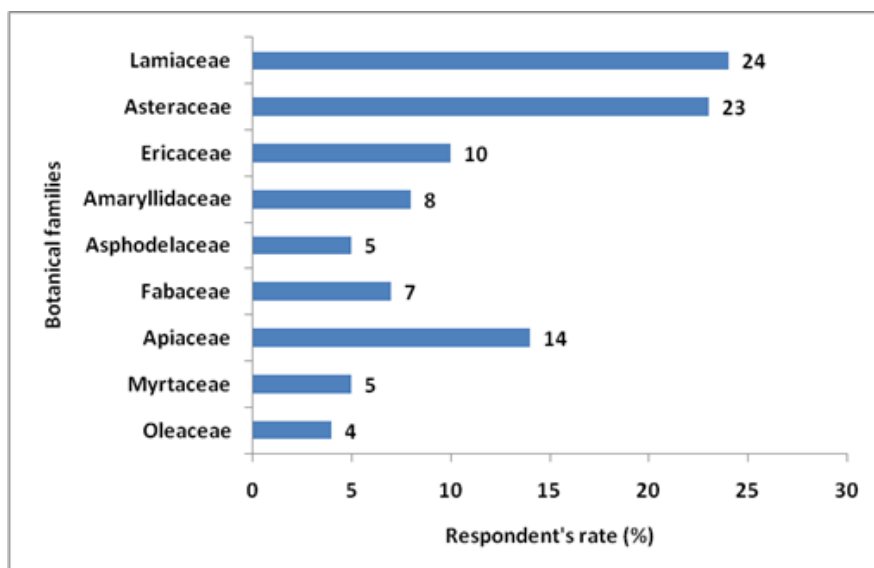


Figure-5: Respondent's rate of botanical families surveyed in the four study areas of North-western Tunisia.

Plant organs used and methods of preparation and application

According to the survey results, leaves were the most utilized vegetative organ in 42% of the cases. Leaf stems, leaf flower stems, and leaf flowers were the next most frequently used as shown by the rates, 23%, 15%, and 10%, respectively. In the same context, less than 4% of respondents say they used other organs, such as seeds, bark, flowers, and fruit (Table-3).

Also, the interviews reveal various methods of preparing traditional plant-based remedies. It is worth noting that decoction is the most used method (37%), followed by infusion (24%). Furthermore, a small percentage of respondents (11%) reported distributing fresh plants to animals. These included powder preparation, maceration, and essential oil, which represented 10%, 9%, and 6%, respectively (Table-3).

According to the survey, respondents utilized a variety of therapeutic methods such as ethno veterinary products which were mainly administered orally (65%), followed by external use through fumigation (13%) and feeding (11%) was also a prevalent method among respondents. Additionally, other modes of administration, such as ointment, poultice, and rinsing, were also utilized in treatment livestock pathologies (Table-3).

Table-3: Respondent's rate about the plant parts used, remedy preparation and application methods in the four study areas of North-western Tunisia.

Plant parts used	Respondent's rate (%)	Remedy preparation	Respondent's rate (%)	Administration methods	Respondent's rate (%)
Leaf	42	Decoction	37	Oral	65
Stem leaf	23	Infusion	24	Fumigation	13
flower	15	Maceration	9	Ointment and cream	5
Bulbe	3	Oils	6	Cataplasm	2
Seed	2	Powder	10	Rinses	4
Fruit	2	Fresh	11	Feeding	11
Leaf flower	10	Others	3	-	-
	3	-	-	-	-

Ethno-veterinary practices and pathologies treated of animals

It is worth noting that ethno-veterinary practices are commonly used to treat various livestock pathologies, including digestive disorders (26%) and diarrhea (20%), followed by bronchitis (18%). These findings were revealed through ethnobotanical investigations conducted in the four regions mentioned in Figure 1. Also, according to the survey, the local population utilizes alternative therapeutic practices to address dermatological conditions like scabies (6%) and lameness (6%). Moreover, plants are utilized to address reproductive problems and heat stress (3%). The survey also indicates that certain medicinal plants possess antiseptic properties (5%) (Fig. 6A). On the other hand, the most animals treated were sheep (28%) and goats (20%), followed by bees (15%), poultry (13%), and cattle (12%). The remaining animals treated were rabbits (5%), dogs, cats, and horses (7%) (Fig. 6B).

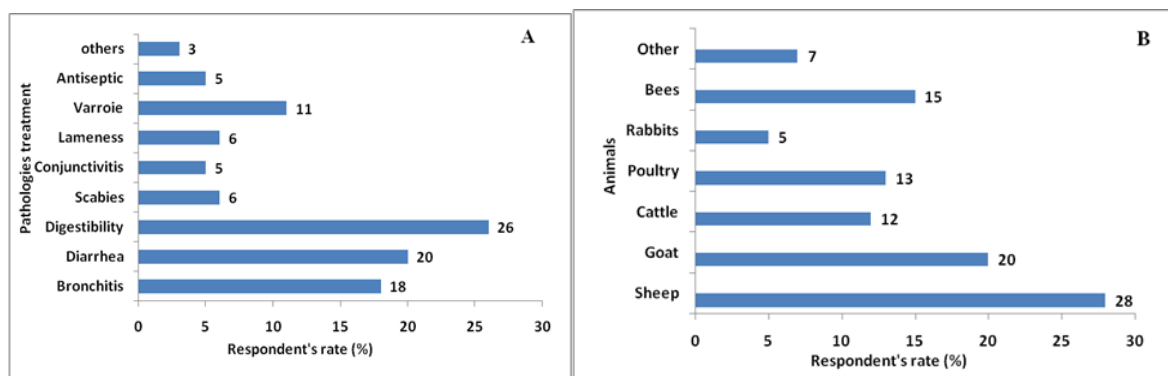


Figure-6 : Respondent's rate about (A): the treatment for pathologies and (B): the treated animals in the four study areas of North-western Tunisia.

IV. Discussion

The ethno-veterinary survey conducted in the four regions of North-western Tunisia provided valuable insights into the traditional veterinary medicine system.

Section 1: Survey population profile

The first part of the survey focused on the profile of respondents, who were elderly individuals over the age of 60. These findings corroborate the ideas given by references (Dhifallah et al., 2022; Jdai et al., 2016; Brinsi et al., 2022). This suggests that ethno-veterinary practices are deeply rooted in ancestral knowledge and that the main source of information on the use of phytotherapy plants is accumulated experience over time. By interpreting findings, the majority of surveyed respondents in North-western Tunisia are women (59%). This confirms observations made by several studies (Boutabia et al., 2020), which shows that women are still present on the farm and know how to use medicinal plants to treat animal diseases compared to men. Notably, these findings differ from those of Merazi et al. (2016), who did not find gender differences with respect to ethno veterinary practice knowledge.

Overall, these studies suggest that 47% of the population surveyed is illiterate. Similar results were obtained in Algeria by Torres-avilez et al. (2016) and in Tunisia by Dhifallah et al. (2022), where the illiteracy rate exceeded 55%, confirming that traditional practices are inversely proportional to the level of education.

Surprisingly, data collected in North-West Tunisia shows that university graduates are increasingly participating in the cultivation of aromatic and medicinal plants (20%). This contrasts with the findings of the work of Brinsi et al. (2022) and Hamel et al. (2018) in Morocco (7% and 14.33% respectively). These differences can be explained in part by the strategies adopted by Tunisian universities in terms of research and they integrate specialties that reinforce the practical skills of graduates and promote an entrepreneurial spirit that encourages young people to innovate and undertake in this promising value chain with high added value.

In terms of the surveyed population's status, 42% are members of breeding farms and professional organizations operating in the aromatic and medicinal plant sector, such as agricultural development groups, mutual agricultural service companies, and economic interest groups. These findings are broadly consistent with the observations made by Zaher et al. (2018), regarding the evolution and dynamics of professional structures advocating for their trade in aromatic and medicinal plants (AMP). In fact, answering to the question "what is your source of information about ethnoveterinary medicine?" 57% indicated that they refer to heritage added to that accumulated experience.

Section 2: Ethno veterinary and plant information

Based on our ethnobotanical investigation, it was found that 55% of those surveyed use ethnoveterinary medicine, while 33% use modern medicine, and 12% use both alternatives. These findings are consistent with Lucie and Florence (2023), who noted that in certain countries, such as Benin, the majority of livestock farmers resort to ethnoveterinary practices at the first signs of illness or to improve zootechnical performance. However, these results differ from those of Tchetan et al. (2021) who showed that, in Morocco, where only half of the farmers follow this practice. This combination would enable the benefits of both types of medicine modern and traditional to be harnessed for the rational management of livestock farms.

The surveyed indicates that respondents use aromatic and medicinal plants not only for their effectiveness (47%) but also for their cost-effectiveness (26%), particularly since the majority of the interviewed breeders reside in mountainous areas. This reinforces observation that natural remedies are a viable solution for breeders to protect their livestock from pathologies (FAO, 2012). In addition, this study reveals the wealth of aromatic and medicinal plants in the northwest regions of Tunisia, identifying a total of 54 species from 37

botanical families. The most represented families were Lamiaceae (24%) and Asteraceae (23%). These rates are consistent with those found by El hafian et al. (2014), in a floristic analysis of the Moroccan central plateau, where found that the families with the greatest specific diversity were Lamiaceae (20.52%).

After analysing the collected information, leaves were found to be the most commonly used parts, at a rate of 42%, followed by leafy stems (23%). It is worth noting that these practices were also observed in Morocco by Brinsi et al. (2022), where equally noticed that local populations mainly use leaves (56%) that were harvested during the flowering season in early summer to prepare their medicine. As mentioned in the review of literature, there are many authors such as El hilah et al. (2016), who confirmed that leaves have significant importance in traditional medicine. In addition, Merazi et al. (2021) mentioned that the most commonly used organs are the easiest to harvest.

When talking about how plants are used, decoction (37%) is reported by respondents to be the most commonly used preparation method. Infusion (24%) and ingestion (11%) came next. These results are in line with those obtained by El hilah et al. (2016). Contrarily to Ogni et al. (2014) and Torres-avilez et al. (2016), have conducted studies on medicinal plants in Algeria and Morocco respectively, they confirmed that the most commonly used method is infusion (57%), particularly using shade-dried leaves.

In this study, the majority of surveyed breeders reported using plants by mouth feeding (65%) to treat digestive diseases in animals as it was previously noted by El hilah *et al.* (2016), who found that oral administration accounted for a cumulative rate of 70%. The investigation shows that digestive disorders (46%) are the most commonly treated pathologies in traditional veterinary medicine to improve digestive transit, alleviate diarrhea, reduce intestinal inflammation and eliminate gas in animals, particularly small ruminants. Similarly, Boutabia et al. (2020), in Sidi Bel Abbes region of Algeria, mentioned that medicinal plants are sometimes used to treat digestive disorders, particularly diarrhea (31.67%). On the other hand, Talebi *et al.* (2020) advise breeders, because high-frequency parasitic pathologies are sometimes associated with digestive system disorders which can unfortunately lead to a mortality rate of 24%. Based on previous findings suggesting a link between medicinal plants and their therapeutic activities, Tajini et al. (2024) reported that natural substances derived from plants and with biological activity as the synthesized drugs but without side effects, constitutes an important scientific challenge, especially with spontaneous plants. This research set out to identify a number of species as being used to treat digestive disorders like *Lavandula angustifolia L.* (58%), *Ocimum forsskaolii Benth* (47.6%), *Polypodium vulgare L.* (36.4%), and *Chamaemelum nobile L.* (31.4%). These outputs suggest that additional phytochemical studies should be conducted on these plants, since information on their traditional therapeutic use is currently limited.

V. Conclusion

This is the first report on the use of medicinal plants as an ancestral practice handed down in the north-western regions of Tunisia. It was observed that this practice is closely linked to the profile of the elderly, with women having a better knowledge of medicinal plants. Through this study, we developed a database containing information on 54 types of medicinal plants, their remedies and the frequency of their use to treat digestive animal pathologies and improve performance. Note that, most practitioners are not scientists. In fact, many lack literacy, expertise in application and preservation methods, as well as precision in diagnosing diseases. Our main objective from the investigation is to have a list of some medicinal plants from Northwest Tunisia such as *Lavandula stoechas L.*, *Ocimum forsskaolii Benth*, *Polypodium vulgare L.* and *Camomille nobile L.* and to control the activity of the ruminal ecosystem both in vivo and in vitro, which optimize its functioning, and reduce polluting emissions (nitrogen and methane) by animals. Subsequently, continuing these studies remains a challenge, as we evaluate their botanical, phytochemical, ethnobotanical, and biological potential in vivo and in vitro. This can improve the performance and health of the animals, enhance the quality of the products and encourage farmers to maintain and promote their ethnoveterinary practices (Sacramento *et al.*, 2022).

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References

- [1] Baerts M., Lehmann J., Ansay M., 2002. The Use Of Plants In Traditional Veterinarian Medicine In Sub-Saharan Africa : Yesterday, Today And Tomorrow. In : Fleurentin J. (Ed.), Pelt J.M. (Ed.), Mazars G. (Ed.), Lejosne J.C. (Trad.) P. 148-166.
- [2] Boutabia L., Telailia S., Menaâ M., 2020. Traditional Therapeutic Uses Of Marrubium Vulgare L. By Local Populations In The Haddada Region (Souk Ahras, Algeria). *Ethnobotany Research And Applications*, 19:44.
- [3] Brinsi C., Selmi H., Jedidi S., Sbai H., 2022. Enquête Ethnopharmacologique Sur L'usage Traditionnel De L'aneth (Anethum Graveolens L.) Dans Le Nord-Ouest De La Tunisie. *Revue Marocaine Des Sciences Agronomiques Et Vétérinaires*, 10(2): 282-286.

- [4] Dhifallah A., Selmi H., Ouerghui A., Et Al., 2022. Medicinal Plants Comparative Study Of Phenolic Compounds And Antiradical Activities Of Four Extracts Of Tunisian Artemisia Herba Alba. *Pharmaceutical Chemistry Journal*, 56 (2): 147-152.
- [5] El Hafian M., Benlamdini N., Elyacoubi H., Zidane L., Rochdi A., 2014. Etude Floristique Et Ethnobotanique Des Plantes Médicinales Utilisées Au Niveau De La Préfecture D'agadir-Ida-Outanane (Maroc). *Journal Of Applied Biosciences*, 81: 7198-7213.
- [6] El Hilah F., Ben Akka F., Bengueddour R., Rochdi A., Zidane L., 2016. Etude Ethnobotanique Des Plantes Médicinales Utilisées Dans Le Traitement Des Affections Dermatologiques Dans Le Plateau Central Marocain. *Journal Of Applied Biosciences*, 98: 9252 – 9260.
- [7] Fao, 2012. Report On The Sustainable Livestock Development Strategy (2012-2035). <https://www.fao.org>
- [8] Hamel Bat., Sadou N., Seridi R., Boukhdar S., 2018. Pratique Traditionnelle D'utilisation Des Plantes Médicinales Dans La Population De La Péninsule De L'edough (Nord-Est Algérien). *Ethnopharmacologia*, 59 : 65-71.
- [9] Jdaïdi N., Hasnaoui B., 2016. Etude Floristique Et Ethnobotanique Des Plantes Médicinales Au Nord-Ouest De La Tunisie: Cas De Communauté D'ouled Sedra. *Journal Of Advanced Research In Science And Technology*, 3 (1): 281-291.
- [10] Lucie D., Florence P., 2023. Les Producteurs-Cueilleurs De Plantes Aromatiques Et Médicinales (Pam) En France Hexagonale Et En Guyane : Convergences, Singularités Et En Jeux. *Développement Durable Et Territoires*, 14(1):1-20.
- [11] Merazi Y., Hammadi K., Fedoul F.F., 2016. Approche Ethno-Vétérinaire Des Plantes Médicinales Utilisées Dans La Région De Sidi Bel Abbes, Algérie. *European Scientific Journal*, 12(18): 218.
- [12] Merazi Y., Hammadi K., Fedoul F.F. (2021) An Investigation Of The Practices Of Veterinarians And Breeders In The Prevalence Of Antibiotic Resistance In Poultry Farms In Algeria. *Revue Nature Et Technologie*, 13 (2): 14-33.
- [13] Ogni Ca, Kpodekon M.T., Dassou H.G. Et Al., 2014. Inventaire Ethno-Pharmacologique Des Plantes Utilisées Dans Le Traitement Des Pathologies Parasitaires Dans Les Elevages Extensifs Et Semi-Intensifs Du Bénin. *International Journal Of Biological And Chemical Sciences*, 8(3): 1089-1102.
- [14] Sacramento T.I., Agbodjento E., Agbogba F., Ategbo J.M., 2022. Enquête Ethno-Vétérinaire Et Activité Antiparasitaire Des Pépins De Citron Utilisés Pour Le Traitement Des Affections Parasitaires Des Aulacodes Au Sud-Bénin. *International Journal Of Biological And Chemical Sciences*, 16(1): 315-328.
- [15] Talebi F., Malchi F., Abedi P., Jahanfar S., 2020. Effect Of Dill (*Anethum Graveolens* Linn) Seed On The Duration Of Labor: A Systematic Review. *Complementary Therapies In Clinical Practice*, 41: 101251.
- [16] Tajini F., Jelassi A., Hamdani A., Salem A., *Abdelhedi O.*, Ouerghui A., Sebai H., 2024. Antioxidant Activities And Laxative Effect Of Bioactive Compounds From *Cynara Cardunculus* Var. *Sylvestris*. *Sains Malaysiana*, 53(7): 1617-1630.
- [17] Tchétan E., Olounlade A. P., Azando E. V. B., Quinet M., Marcotty T., Hounzangbe-Adoté S. M., Quetin-Leclercq J., Gbaguidi F. A., 2021. La Médecine Ethnovétérinaire A La Croisée De La Recherche Scientifique : Synthèse Des Connaissances Et Perspectives. *Revue D'élevage Et De Médecine Vétérinaire Des Pays Tropicaux*, 74 (3): 167-175.
- [18] Torres-Avilez W., De Medeiros P. M., Albuquerque U. P., 2016. Effect Of Gender On The Knowledge Of Medicinal Plants: Systematic Review And Meta-Analysis. *Evidence-Based Complementary And Alternative Medicine*, 2016:1-13.
- [19] Who., 2013. Strategy For Traditional Medicine, 2014-2023. <https://www.who.int>
- [20] Zaher A., Boufellous M., Jaber H., El Hartiti H., Barrahi M., Ouhsine M., Bourkhiss B., 2018. Ethnobotanical Study Of Medicinal Plants Used In The Province Of Sidi Slimane (Morocco). *Journal Of Biosciences And Medicines*, 6: 25-35.