

# Ethno-veterinary study of plants in the pastoral region of Naâma (Algeria)

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**Keywords:** ethno-veterinary, survey, medicinal plants, livestock, animal diseases, Naama, Algeria.

Submitted 20/05/2025, Published online on 31<sup>st</sup> July 2025 in the [Journal of Animal and Plant Sciences \(J. Anim. Plant Sci.\) ISSN 2071 – 7024](#)

## 1 ABSTRACT

The present work focuses on the study and examination of remedies based on ethnoveterinary medicinal plants used by the local population in the treatment of animal diseases in the pastoral region of Naama (southwestern of Algeria). The objective of this study is to find, evaluate and document ethnoveterinary practices used to treat sheep through medicinal plants. An ethno-veterinary survey was carried out among 80 informants using a semi-structured questionnaire in the field in order to establish a list of plants for therapeutic use practiced in the study area after interviews with veterinarians and breeders in the Naama region. A total of 21 medicinal plants were documented belonging to 14 botanical families for the treatment of different livestock diseases by breeders in the study area. The analysis of the results obtained allowed us to identify cultivated and spontaneous medicinal species, which are used as remedies against various animal diseases. These plants are dominated by poaceae, amaranthaceae and asteraceae. The most used plants are *Hammada scoparia* (Remth), *Artemisia herba alba* (Chih) and *Peganum harmala* (Harmel) which have a consensus factor ( $\geq 0.1$ ) particularly used in the treatment of diseases of the digestive system, stomach, intestinal worms and poisoning. The leaves are the most used parts (27.77%) for the treatment of digestive and respiratory diseases, either in decoction or infusion in order to get the most active ingredient. Indeed, few breeders are interested in traditional medicine because more than 80% approach the veterinarian for the treatment of various pathologies. The consultations made by veterinarians exceed 67% where the main diseases detected are (enterotoxemia, sheep pox, mastitis, scabies, arthritis...). This study presents a basic reference to acquire information on therapeutic and traditional applications in veterinary livestock medicine, and ensured a link between ancestral practices and conventional medicine. Indeed, the documentation of surveys on ethnoveterinary medicinal plants is of vital importance to find medicines needed to cure various veterinary diseases in the region.

## 2 INTRODUCTION

In Algeria, agropastoralism occupies a prominent place in the national economy in general and in particular in the steppe areas. With more than 29 million heads of sheep, where the livestock farming is represents the first predominant function in the steppe agroecological zones. It contributes significantly to poverty reduction and economically viable

development in improving sustainable food security in Algeria (meat, milk and its derivatives, wool, etc.) (MADRP, 2021). The small ruminant breeding sector constitutes one of the main sources of meat supply in Algeria and plays a vital role for the country's food security. The small ruminant sector in Algeria has the potential to improve the standard of living of breeders and



households while increasing the supply of proteins of animal origin available to consumers, thereby alleviating poverty and to improve public health (Kardjadj, 2017). Like the steppe zones, the South Oran steppe of Naama is a region with an essentially pastoral vocation and the economy is largely based on livestock breeding. This pastoral system in a steppe environment presents an important ancestral adaptation while ensuring the subsistence of the pastoral population in an arid steppe ecosystem. It is in the pastoral zone that breeders and their herds can exploit all the available spaces and all the resources of their environment. It contributes to food security and provides an essential source of income and employment to agropastoralists for the majority of the population (Bencherif and Slimani, 2021; Benaradj, 2017; Boucherit, 2018). Despite its importance, livestock farming is faced with climatic problems, frequent economic, social and environmental changes and diseases threatening small ruminants, the impact on the Algerian economy is considerable. Among the main diseases threatening the small ruminant sector are peste des petits ruminants, diarrhoea, bluetongue, foot-and-mouth disease, sheep pox, goat pox, brucellosis, gestational toxemia, dictyocaulosis, abortion, foot rot, necrotic enteritis, arthritis, digestive strongylosis, stomatitis, leptospirosis, scabies, pleuropneumonia, enterotoxemia, catarrhal, ecthyma. Faced with this alarming situation, it is necessary to set up early warning systems and ensure the appropriate implementation of control measures in order to prevent, control and/or eradicate these diseases through curative treatments and preventive medicinal or traditional treatments (case of ethnoveterinary) (Di Sanzo, 2013; Kardjadj, 2017). The health of the potential of the sheep herd remains one of the strategic elements to lead to the improvement of productivity. The practice of ethnoveterinary medicine is linked to animal breeding and health within a human society (Cornillet, 2012). Ethnoveterinary covers the use of plants by humans to prevent, control and cure livestock diseases. It deals with all the traditional

techniques applied by man not only to control common diseases of domestic animals but also to improve their breeding practices (Guzman, 2015). In the Naama region, livestock breeding is the second socio-economic activity of the local population. It represents an important sector for the livelihoods of residents and also provides several types of products that generate income for livestock breeders and agropastoralists. Like all living beings, animals are susceptible to certain diseases which can affect not only their well-being and health status, but also their production and reproduction performance. With this objective and in order to determine the different diseases and the care to be provided, our study was carried out with breeders and veterinarians in the Naama region. Ethnoveterinary medicine often contains ingredients from various places in the environment and can include plants, animals and minerals. It deals with disease prevention, the preparation of a vast pharmacopoeia and the fight against pathologies (viral, bacterial, parasitic, etc.) (Mazouz and Mokrane, 2018). Ethnoveterinary medicine exists wherever humans live in close relationship with animals, and it is particularly relevant in societies where livestock breeding is the main means of subsistence (Huffman, 2001, 2003; Pieroni, 2006). Ethnoveterinary medicine deals with people's knowledge, skills, methods, practices and beliefs about the care of their animals (McCorkle, 1986). Ethnoveterinary knowledge is acquired through practical experience and has traditionally been passed down orally from generation to generation (Ngeh *et al.*, 2007). Several studies have valued the practice of traditional care in the treatment of livestock diseases (Mbarubukeye, 1994). Nowadays, these traditional remedies are encouraged in veterinary medicine because of their promising therapeutic efficacy, minimal side effects of chemotherapeutic agents and reduced drug residues in animal products consumed by humans (Saidi, 2019). Medicinal plants constitute valuable resources for the majority of rural and urban populations in Africa and represent the main means by which individuals



heal themselves (Badiaga, 2011). Algeria, through the richness and diversity of its flora, constitutes a real phylogenetic reservoir, with approximately 4000 species and subspecies of vascular plants (Dobignard and Chatelain, 2010-2013). Traditional medicine is knowledge that is passed down from generation to generation. Given the ease of preparing and administering

herbal medicines and its free nature, ethno-veterinary medicine occupies a significant place in the practices of Algerian breeders (Merazi, 2016). This study was carried out to explore the traditional knowledge of ethnoveterinary practices followed by local breeders and veterinarians in the pastoral region of Naama (western Algeria).

### 3 MATERIALS AND METHODS

**3.1 Study area:** The Naama region is located in the southwestern part of Algeria, between the Tell Atlas to the north and the Saharan Atlas to the south. It covers an area of 29,819.30 km<sup>2</sup> (approximately 3 million hectares), which represents 1.14% of the national territory. It has a large set of ecosystems and biological diversity. Naama area is situated between (between parallels 32°08'45" and 34°22'13" North and between 0°36'45" and 0°46'05" West longitude), lies under the administration of province of Naama, Algeria. The climate of the Naama region is characterized by an arid Mediterranean climate with low and irregular rainfall (200 mm/year) and a fairly long dry period of 6 to 7 months, characterized by low temperatures generally falling below -4°C

(Benaradj, 2009; Benaradj, 2017; Boucherit, 2018, Benaradj *et al.*, 2021). In the wilaya of Naama, the first important economic sector is agriculture; precisely pastoralism. It remains a secondary means of production, a palliative to partially meet the needs of the herds. It has a very marked agricultural and pastoral vocation, with an extensive territory including vast rangelands which are home to a considerable livestock population plus 1 million head of sheep. The practice of livestock breeding in the wilaya of Naama constitutes the basic activity of a large part of the rural population, given the pastoral vocation of the region. The most common sheep herd management system in the region is the pastoral or semi-pastoral system.

**Table 1.** Distribution of livestock in the wilaya of Naama (DPSB, 2021)

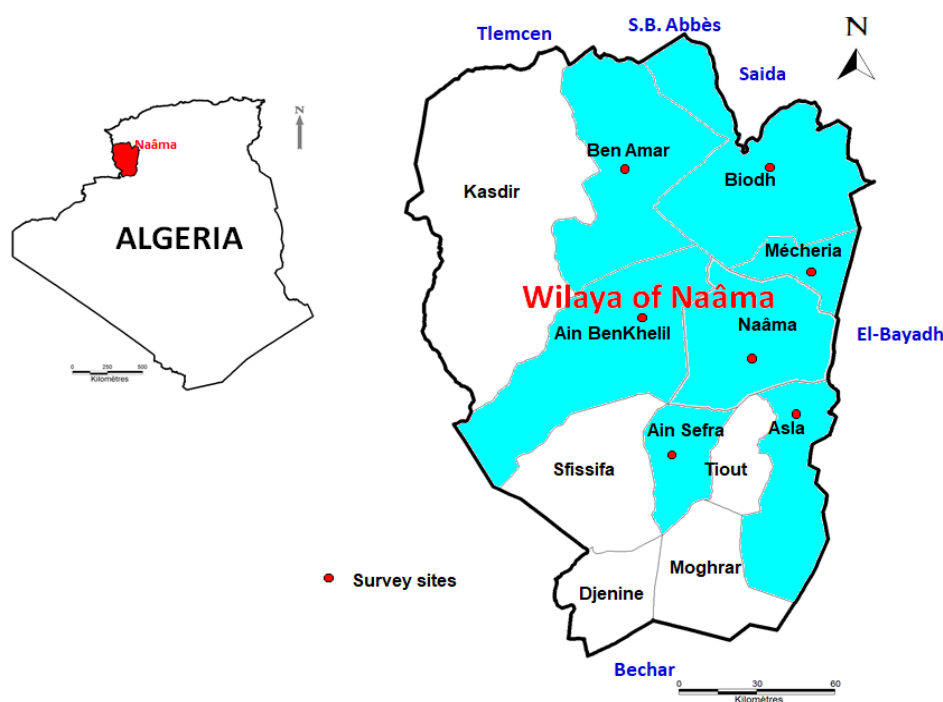
Municipality	Sheep	Cattle	Goats	Camels
Naama	134,154	3,348	8,690	70
Mecheria	60,547	2,061	4,196	0
Ain-Sefra	103,883	2,601	6,917	12
Tiout	92,975	808	6,186	186
Sfissifa	149,456	2,832	9,711	0
Moghrar	37,092	238	4,194	1,053
Asla	126,336	1,365	8,283	512
Djenien Bourezg	21,998	86	2,861	11
Ain-Ben Khelil	261,091	5,288	16,638	0
MekmenBen-Amar	216,000	5,146	13,811	0
Kasdir	275,342	3,330	9,990	0
El-Biodh	218,660	5,682	13,911	0
Total	1,697,534	32,785	105,388	1,844

According to Table 1, livestock farming in the study region is represented by sheep (1,697,534 heads), goats (105,388 heads), cattle (32,785 heads) and camels (1,844 heads). These figures

highlight the importance of sheep farming in the region which is positioned at the forefront. It is the activity of agropastoralism which most widely dominates the steppe region of Naama.

**3.2 Field survey:** Since ethnoveterinary therapy is now widely used worldwide, our approach is based on similar work on ethnoveterinary practices carried out in several regions in Algeria (Merazi *et al.*, 2016 in the Sidi Bel Abbès region; Ammar *et al.*, 2022 in the El-Oued region; Aliouane, 2018 in the Tizi-Ouzou region; Kertous and Benhallou, 2021 in the Mostaganem region). In order to collect information on the use of medicinal plants for animal care in the pastoral region of Naama, this work is based on field investigations and aims to document the medicinal plants used in veterinary diseases. The survey is carried out using a semi-structured questionnaire among 30 veterinarians and 50 breeders spread over 6

study locations (Mecheria, Ain Ben khelil, Mekmen Ben Amar, Asla, El-Biod and Ain Sefra) in the wilaya of Naama for a period of three months. These questionnaires were administered as a quantitative research tool to collect information on the socio-demographic characteristics of the respondents, the main animal diseases encountered, the pharmaceutical treatments used, and the ownership of livestock and the dynamics of herds, breeding and livestock health management, medicinal plants used. The choice of study locations is based on the ease of access and the presence of the large number of respondents who have a large number of animal livestock.



**Fig.1:** Geographic location of survey sites

**Table 2:** Distribution surveys of breeders and veterinarians according to stations.

Survey sites	Breeders	Veterinarians	Total
Naama	/	6	6
Mecheria	16	9	25
Ain Ben Khelil	18	6	24
Mekman Ben Amar	6	8	14
Asla	5	/	5
El Biodh	3	1	4
Ain Sefra	2	/	2
Total	50	30	80

**Data analysis :** Knowledge on medicinal plants used in the treatment of diseases by the population of the study area was analysed using the Informant Consensus Factor (ICF) of the medicinal plant species cited. In order to assess the informants on the use of plants against any disease or symptom, a consensus factor of use or Informant Consensus Factor (ICF) was calculated according to the following formula:

$ICF = Na/Nt$  (Cotton, 1996 and Ilumbe *et al.*, 2014)

Where: Na is the number of informants who cited a species; Nt the Total number of informants.

## 4 RESULTS

### 4.1 Survey among Breeders

**4.1.1 Sociodemographic characteristics of respondents:** Regarding the age of the respondents, in the study region the majority of respondents are animal breeders (94%), and (6%) women have more knowledge about animal care through plants. The respondents are adults (46%) whose average age varies from 40 to 60 years, in fact the relatively elderly populations over 60 years (42%), showed more knowledge and great interest in the uses and properties of medicinal plants, compared to generations under 40 years. Regarding the

gender of the respondents, men (96%) have a fairly significant knowledge compared to women (6%) on the use of medicinal plants. This explains why livestock breeding is an activity that mainly concerns men in the pastoral population. Regarding the level of education, most of the respondents were illiterate (46%). The rest of the interviewees had often studied at the primary level (22%) and some at the secondary level (26%) and 6% are university graduates (Tab.2). Indeed, the emergence of modern practices prevents the younger generations from using the knowledge and practices of their ancestors.

**Table 3.** Profile general of the surveyed

Settings		Number	Percentage (%)
Age (years)	30 to 40	6	12%
	40 to 60	23	46%
	More than 60	21	42%
Sex	Women	3	6%
	Man	47	94%
School level	Illiterate	23	46%
	Primary	11	22%
	Secondary	13	26%
	Academics	3	6%

**4.2 Livestock activity, the health status of livestock and the control interventions of breeders:** According to the results of the study carried out on 50 breeders, it is noted that the majority of animals raised in the study region are sheep with 9480 heads and poultry 10170; then goats 657 heads, and a very small number of cattle (208 heads), beekeeping (72 hives). Thus, it is also noted that the majority of breeders

surveyed 70% practice livestock breeding activity, and 30% of breeders have a mixed activity (agriculture and livestock breeding). Agropastoralists raise livestock to meet household food demand and as a source of income. The table below shows the health status of the sheep herd in the study sites among the breeders surveyed.



**Table 4.** Animal number repair per breeder in the study sites

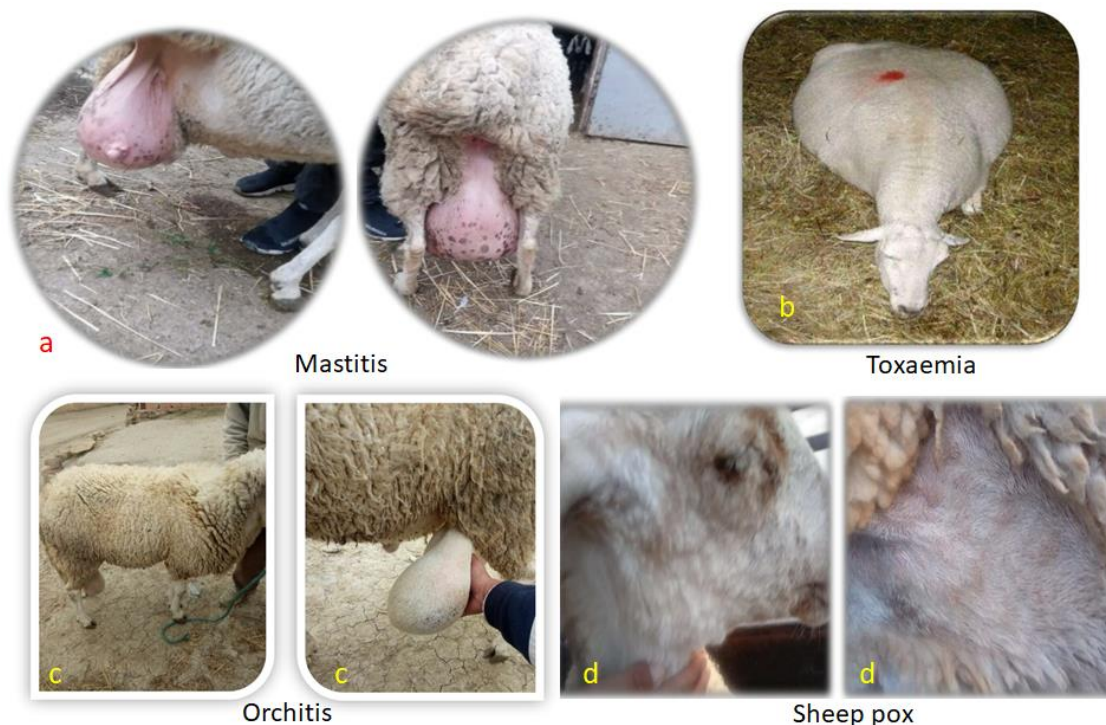
	Sheep		Cattle		Goats		Poultry	Beekkeeping
Survey sites	Rams	Sheep	Calves	Cows	Goatees	Goat	Number	Number of hives
Ain Ben Kheill	2020	651	45	27	155	59	10017	50
Mecheria	2720	1247	78	52	320	147	153	22
Mekmen Ben Amar	2635	0	58	0	106	0	0	0
Asla	935	56	0	0	0	0	0	0
El Biodh	470	290	27	8	56	38	0	0
Ain sefra	700	665	0	20	17	0	0	0
Total	9480	2909	208	87	657	261	10170	72

**Table 5.** State of attack of sheep diseases of the breeders surveyed at study stations

Study locations	Number of sick heads
Ain Ben Khlill	(2-75)
Mecheria	(2-50)
Mekmen Ben Amar	(2-100)
Asla	(24-50)
El Biodh	(2-40)
Ain sefra	(2-100)
Total	208

According to the results of the survey reported by the breeders (Fig.2) we note that the most frequent diseases are: urinary system (25.33%), digestive system (24.66%), skin (18%),

respiratory system (8.66%), and genital system (6.66%), nervous system (5.33%) are the least responded, the other diseases rarely noticed skeleton (2%) and hearing system (0.66%).

**Fig.2.** Examples of animal diseases from breeders (image Source Dr Benameur A.)

When the disease appears, more than 80.43% of farmers resort to treatment with pharmaceutical products. However, 17.39% of farmers confirm

that they use traditional remedies and veterinary drugs, and very few farmers (2.17%) use medicinal plants.

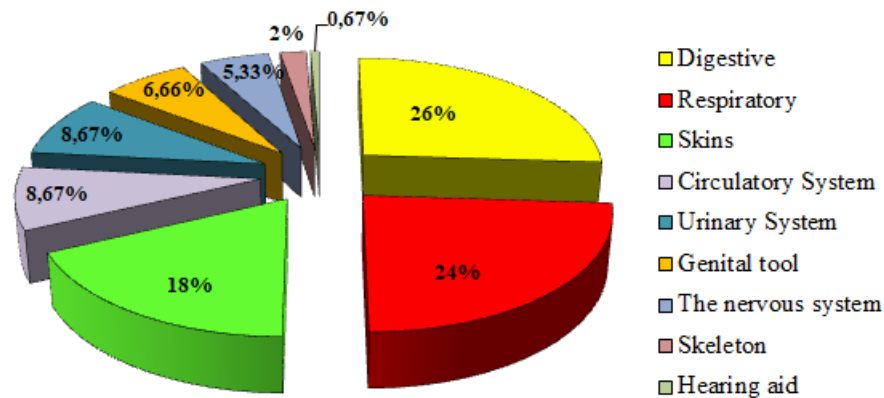


Fig. 3. Different types of diseases

**4.3 Medicinal plants used in ethno-veterinary practices by respondents:** In total, twenty-one (21) species are used in the treatment of animals; they are generally herbaceous plants, trees and shrubs. The most represented plants are: *Hammada scoparia* (15.62%), *Artemisia herba-alba* (12.50%), *Peganum harmala* (9.37%), *Echinops spinosus* and *Thymus vulgaris* (6.25%), followed by

the species *Stipa tenacissima*, *Triticum aestivum*, *Avena sativa*, *Atriplex halimus*, *Medicago sativa*, *Prunus persica*, *Allium cepa*, *Plantago albicans*, *Juniperus phoenicea*, *Noaea mucronata*, *Antirrhinum ramosissimum*, *Phoenix dactylifera*, *Ficus carica*, *Punica granatum*, *Pinus halepensis*, *Allium sativum* with 3.12% of each.

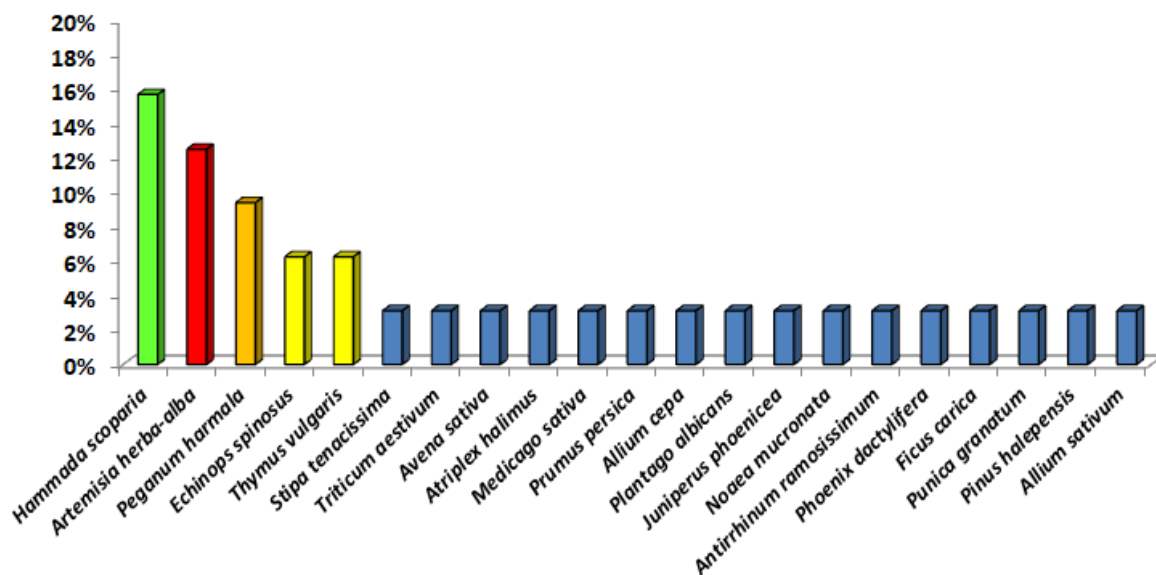


Fig.4. Main plants used in traditional treatments

**Table 6.** Number of medicinal plants used as sources of ethnoveterinary drugs to treat livestock diseases

No.	No. of species	Study region	Country	Authors
1	22	El-Oued	Algeria	Ammar <i>et al.</i> , 2022
2	20	Tizi Ouzou	Algeria	Aliouane, 2018
3	25	Dirrah (Bouira)	Algeria	Benamoud and Dilmi, 2019
4	11	Mostaganem	Algeria	Kertous and Benhallou, 2021
5	24	Sinématiali	Ivory Coast	KONE <i>et al.</i> , 2019
6	55	Wolaita zone, southern	Ethiopia	Wendimu <i>et al.</i> , 2023
7	64	Dugda District	Ethiopia	Oda <i>et al.</i> , 2024
8	33	Mojana Wodera district, central	Ethiopia	Abebe, 2022
9	36	Hassan District Of Karnataka,	India	Manjunatha <i>et al.</i> , 2017
10	17	Golaghat, Assam,	India	Soren <i>et al.</i> , 2021
11	40	Jammu and Kashmir,	India	Sehgal <i>et al.</i> , 2024
12	96	Meghalaya, North East	India	Bhat <i>et al.</i> , 2023
13	65	Madurai District.	India	Aruna & Shrinitha, 2023
14	32	Ilam province	Iran	Bahmani & Eftekhari, 2013
15	41	Khyber Pakhtunkhwa	Pakistan	Tariq <i>et al.</i> , 2014
16	50	Khyber Pakhtunkhwa	Pakistan	Khan <i>et al.</i> , 2019
17	31	Khartoum	Sudan	EL-Kamali and Elshikh, 2015
18	129	Lebanon	Lebanon	Arnold-Apostolides <i>et al.</i> , 2020

#### 4.4 Botanical characteristics of the plants used:

Table (7) below presents the list of plant species identified with the scientific and vernacular names, systematic affiliation (botanical family), vernacular names used in the

study region, and the calculated consensus factor and therapeutic use. These plants used are generally divided into two types (spontaneous and cultivated).

**Table 7:** List of medicinal plants and their use in ethno-veterinary medicine in the Naama region

No	Species	Vernacular name	Family	Number	Therapeutic use	ICF
1	<i>Stipa tenacissima</i>	Alfa	Poaceae	1	Digestive disorders (diarrhoea, stomach, intestinal worms)	0.032
2	<i>Avena sativa</i>	Oats		1		0.032
3	<i>Triticum aestivum</i>	Wheat		1		0.032
4	<i>Atriplex halimus</i>	Gueta	Amaranthaceae	1	Cholelithiasis (sheep)	0.032
5	<i>Hammada scoparia</i>	Remth		5	Digestives (poisoning)	0.156
6	<i>Noaea mucronata</i>	Chobrog		1	Used for colds	0.032
7	<i>Peganum harmala</i>	Harmel	Zygophyllaceae	3	asthma, stomach, intestinal worms respiratory problems	0.093
8	<i>Artemisia herba-alba</i>	Chih	Asteraceae	4	Any disease (lungs (sheep) stomach, intestinal worms)	0.12
9	<i>Echinops spinosus</i>	Teskra		2	After parturition (partum in (sheep and cattle))	0.062
10	<i>Medicago stiva</i>	Fassa	Fabaceae	1	stomach, intestinal worms	0.032
11	<i>Prunus persica</i>	Khokh	Rosaceae	1	Antiparasitic	0.032

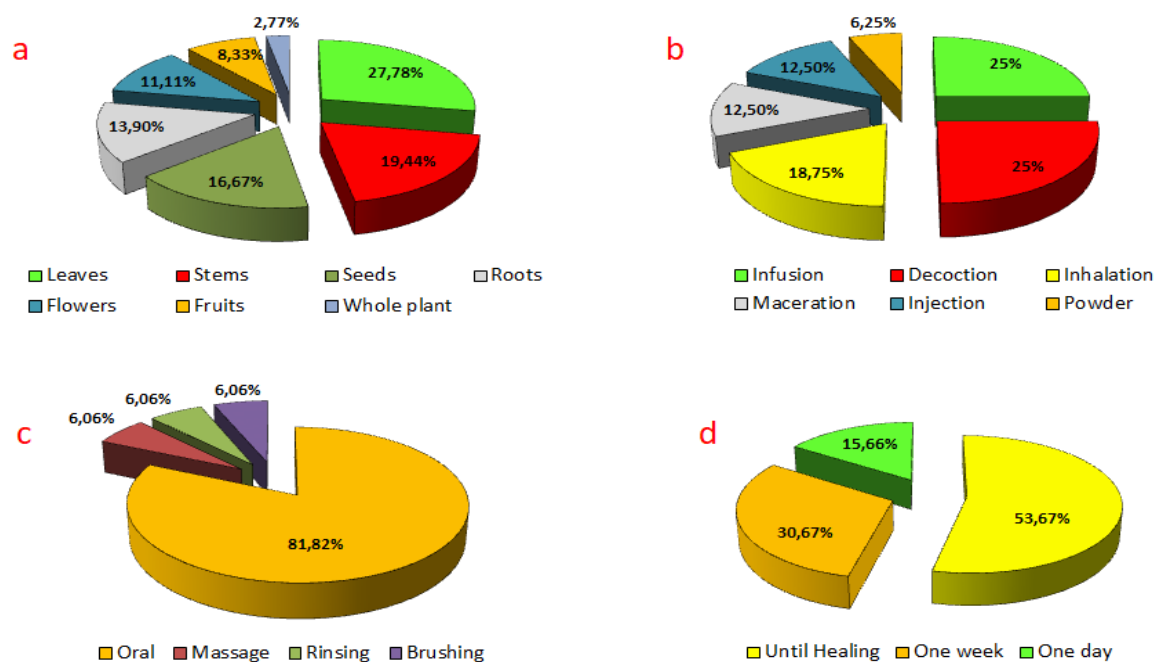


12	<i>Allium cepa</i>	Besal	Amaryllidaceae	1	Swelling of the abdomen (sheep)	0.032
13	<i>Allium sativum</i>	Thum		1	wounds (Maceration) bulbs to treat respiratory disorders	0.032
14	<i>Plantago albicans</i>	Lelma	Plantaginaceae	1	Urinary problem	0.032
15	<i>Juniperus phoenicea</i>	Arar	Cupressaceae	1	mastitis, digestive disorders, scabies	0.032
16	<i>Thymus vulgaris</i>	Zaater	Lamiaceae	2	Digestive disorders (Stomach)	0.062
17	<i>Antirrhinum ramosissimum</i>	Zaazaa	Scrophulariaceae	1	Colds	0.032
18	<i>Phoenix dactylifera</i>	Date	Arecaceae	1	Measles	0.032
19	<i>Ficus carica</i>	Karmous	Moraceae	1	diarrhea	0.032
20	<i>Punica granatum</i>	Roman	Lythraceae	1	Skin conditions	0.032
21	<i>Pinus halepensis</i>	Senouber halabi	Pinaceae	1	Pneumonia	0.032

The twenty-one species belong to 14 botanical families and are used by breeders and the local population of the Naama region. The most represented families are Amaranthaceae and Poaceae (3 species) and Asteraceae and Lamiaceae (2 species) whose species are used to treat mainly digestive and circulatory system diseases. The other remaining families are mono-specific (Plantaginaceae, Cupressaceae, Lamiaceae, Scrophulariaceae, Arecaceae, Moraceae, Lythraceae and Pinaceae) each represented a single species. According to the results of table 5, the consensus factor varies between ]0-1[, it is noted that for the species listed, no index reached the average consensus value (0.5). Two species having obtained a consensus value greater than or equal to 0.1 are: *Hammada scoparia* (0.15) and *Artemisia herba-alba* (0.12).

**4.5 Use of medicinal plants (Part used, Method of preparation and Method of administration):** The results obtained from the ethno-veterinary survey show the use of different parts of the plant (leaf, flower, seed,

stem, fruit, roots and the whole plant). The percentage of uses varies between 2.77 to 27.77% (Fig.5). In the study region, the leaves are the most used parts in the different therapeutic preparations with a percentage of 27.77%, the stems occupy the second position with a percentage of 19.44%, then the seeds with 16.66%, the roots with 13.88% and the flowers with 11.11%, and the fruits with 8.33%, finally the whole plant represented by a low rate 2.77%. Regarding the method of use of the identified species, various methods of preparation were identified: Infusion (25%), Decoction (25%), inhalation (18.75%), Maceration and injection use each represent (12.5%), and powder (6.25%). The majority of respondents (91.66%) use the plant at non-precise doses. The results obtained showed that the oral administration method is of the order of 81.81%. This allowed us to note that the majority of the species inventoried are recommended to breeders and agro-breeders to be used as fodder and treatment of certain pathologies at the same time.

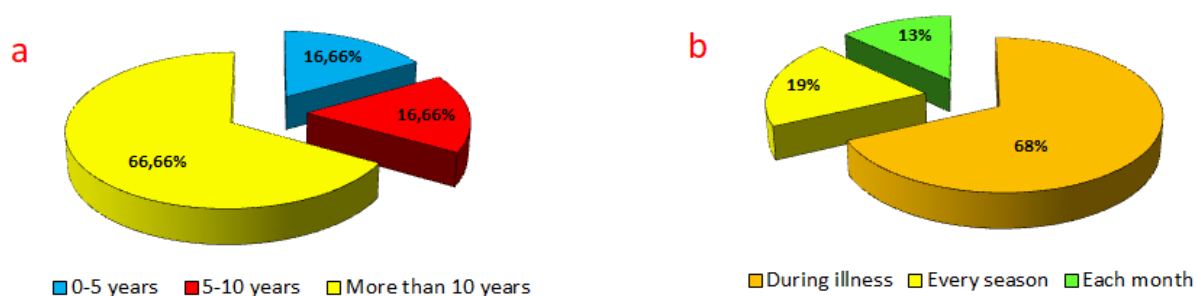


**Fig.5.** Use of medicinal plants a) used parts of plants, b) Methods of preparation, c) Methods of administration, d) Duration of treatment per plant.

#### 4.6 Veterinarian Surveys

**4.6.1 Experience and Frequency of Consultation :** According to the survey results, we noticed that veterinarians who have more than 10 years of experience had a higher rate of 66.66% compared to veterinarians with [0-5]

years and [5-10] years of experience at 16.66%. The frequency of consultation according to the respondents shows that more than 67% of veterinarians intervene when the disease appears, 13.51% each month and 18.91% each season.



**Fig.6.** Use by veterinarians a) experience of veterinarians b) Frequency of consultations

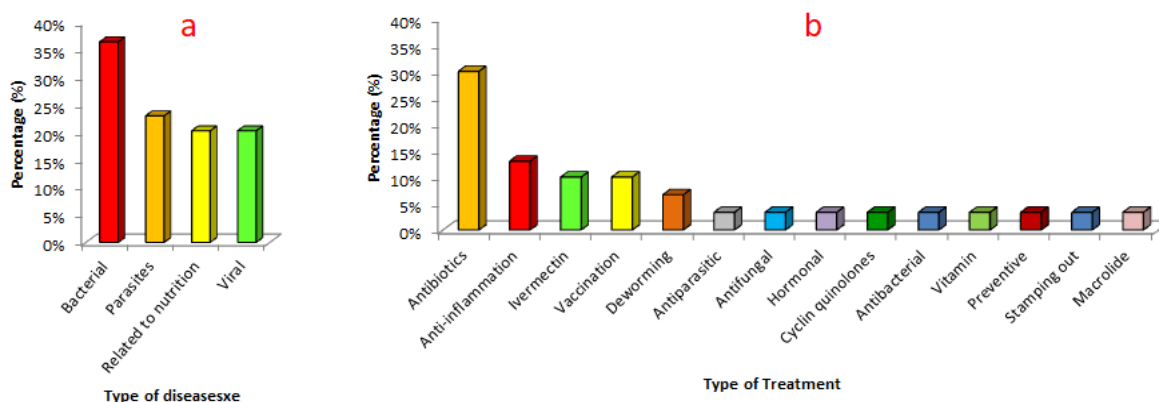
#### 4.6.2 Types of diseases reported and treatments recommended by veterinarians :

There are many diseases that have been described by veterinarians in the Naama region, which affect animals of all ages. There are twenty-five of them, the most commonly reported of which are those affecting the digestive system 26% and respiratory system

24%. The results of the survey with the veterinarian show that the most frequent livestock diseases are mainly bacterial and parasitic with respectively (36.48% and 22.9%), and nutritional and viral diseases with a percentage of 20.27% each. The treatments used by the veterinarians surveyed are antibiotics (30%), anti-inflammation (10%), ivermectin and

vaccination (10% each), deworming (6.66%), antiparasitic, antifungal, hormonal, cycline quinolones, antibacterial, vitamin, preventive,

sanitary slaughter, macrolide with a percentage of (3.33%).



**Fig.7.** used by the veterinarian. a) Most common diseases b) Different treatments

## 5 DISCUSSION

**5.1 Sociodemographic characteristics of respondents:** Merazi *et al.*, 2016 confirmed in their ethnoveterinary study that popular know-how is mainly concentrated among older people. The transmission of this knowledge is currently in danger because it is not always assured by breeders (Anyinam, 1995; Mehdioui and Kahouadji, 2007; Benkhniue *et al.*, 2010; El Hafian *et al.*, 2014). The age group between 40 and 60 years constituting the elderly can use their experience to influence the modern generation to adopt ethnoveterinary practices and also provide information for documentation purposes. She explains that the largest number of respondents received some information transmitted orally by their ancestors. These are people who can also contribute to promoting the adoption of ethnoveterinary practices, because they discover the benefits of using these practices as alternatives to conventional medicines (Clarice *et al.*, 2014). Similar results concerning this age group have also been reported in different studies, for example (Clarice *et al.*, 2014; Manjunatha *et al.*, 2017; Adeniran *et al.*, 2020; Nazir Ahmad Bhat *et al.*, 2023; Wendimu *et al.*, 2023; Sehgal *et al.*, 2024). These results of the level of education are confirm other studies (Mehdioui and Kahouadji,

2007; El Hafian *et al.*, 2014). The frequency of use of medicinal plants is closely linked to the profile of the people surveyed. Thus, young people, compared to older people, generally do not know the names or the usefulness of the majority of plant species. Women also have knowledge about the use of plants but unfortunately only 6% were interviewed. This inherited traditional knowledge and the required knowledge are at risk of being lost due to civilization, current rapid socio-economic, environmental and technological changes and the lack of interest of the younger generation in the use of plants to treat domestic animals.

**5.2 Livestock activity, the health status of livestock and the control interventions of breeders:** The livestock structure of the Naama region is characterized by the dominance of sheep which form 89% of the total population followed by goats with a proportion of 6%, cattle by 3.97% and a low rate of camel 1%. The high concentration of sheep in the north and west of the region, the same remark on the distribution and concentration of cattle and goats, camels only appear in four communes in the south of the region (Haddouche *et al.*, 2008; Yerou, 2013). Livestock production is hampered by widespread animal diseases. These have a

particularly severe impact on the pastoralist community of Naama. According to Eiki *et al.* (2021), these widespread animal diseases lead to loss of livestock and farm productivity, reduced market opportunities, and degraded human welfare.

**5.3 Medicinal plants used in ethno-veterinary practices by respondents:** Given the ease of preparing and administering herbal medicines and its free availability, ethno-veterinary medicine occupies an important place in the practices of breeders in developing countries (Merazi *et al.*, 2016). Therefore, the present study proved that a wide diversity of plants used for the treatment of diseases by the local population of Naama. Medicinal plants still play an important role in the management of diseases. Majority of the pastoral population still depend on herbs for the treatment of their livestock because most of these herbs are easily accessible in their locality. The use of plants is justified because they are cheaper and more accessible. The richness of medicinal species is argued in several ethnoveterinary studies carried out extensively in several regions across the world for the treatment of animal diseases (Tariq *et al.*, 2014; Merazi *et al.*, 2016; Manjunatha *et al.*, 2017; Maroyi, 2021; Abebe, 2022; Wendimu *et al.*, 2023; Sehgal *et al.*, 2024).

**5.4 Botanical characteristics of the plants used:** For the case of Poaceae, according to Kouassi *et al.* (2014), show that these species are succulent and easy to graze by livestock, they have a very high aptitude for tillering and regrowth, when environmental conditions are favourable. The Asteraceae family is better represented, similar results have also been reported in other previous studies on ethnoveterinarian practice, such as Lulekal *et al.* (2014) in Ankober region, North Showa, Amhara region (Ethiopia), Tariq *et al.*, 2014) in Khyber Pakhtunkhwa (Pakistan); Wendimu *et al.*, 2023) in Wolaita zone, southern (Ethiopia); Abebe (2022) in Mojana Wodera district, central Ethiopia. According to Tariq *et al.* (2014), the difference between studies could be related to the different dominant vegetation of the areas or could be associated with the traditional beliefs of

different cultures in the traditional use of specific plants. For the plant harvest period, we note that the majority of plants are harvested in summer (57.14%). Indeed, during the drought period, we observe in certain stations that experience intense aridity or anthropization, the abundance of the pure grouping of Hammada scoparia and other species of the Amaranthaceae and Asteraceae family (Boucherit, 2018).

**5.5 Use of medicinal plants (Part used, Method of preparation and Method of administration):** According to Chehma and Djebbar (2008); Ogni *et al.* (2014), Boucherit and Benaradj (2023), the most used organs are those that are easiest to harvest. The use of leaves has also been documented in a large number of similar ethnoveterinary studies, for example: Monteiro *et al.*, 2011; Tariq *et al.*, 2014; Birhan *et al.*, 2018; Kouassi *et al.*, 2020; Maroyi, 2021; Soren *et al.*, 2021; Abebe, 2022; Eiki *et al.*, 2022; Wendimu *et al.*, 2023; Bhat *et al.*, 2023; Aruna and Shrinitha, 2023; Oda *et al.*, 2024; Sehgal *et al.*, 2024. According to Bigendako and Lejoly, 1990; Akash Tariq *et al.*, 2014, indicate that the leaves are the seat of photosynthesis and storage of secondary metabolites responsible for the biological properties of the plant). Thus, Wendimu *et al.* (2023), explain that fresh leaves of the plant were the parts of the plant most frequently used to make medicines. Sheep are herbivores generally consume the leaves of plants, because they are rich in tender parts which are also more nutritious because they are more easily digestible and richer in nitrogen (Boudet, 1975). According to Salhi *et al.*, (2010), decoction allows the collection of the most active ingredients and reduces or cancels the toxic effect of certain recipes. The duration of treatment depends on the type of disease and the animal's affection rate according to the respondents, where more than 53.84% suggest the use of plants until healing. The same results were confirmed by (Okombe *et al.*, 2014; Merazi *et al.*, *et al.*, 2016; Tchetan *et al.*, 2021). According to Shoaib *et al.* (2020), in traditional therapies, the parts and the method of preparation play an important role in the action of plant taxa used for medicinal purposes.

## 6 CONCLUSION

The wilaya of Naama constitutes a steppe area with an essentially agro-pastoral vocation where sheep farming occupies the first place and has more than a million heads compared to other types of animals. The pastoral livestock system has been essential to the way of life of the inhabitants and their basic production systems. Pastoral livestock farming plays an important vital socio-economic role in improving livelihoods and generates various benefits for the local pastoral population in ensuring food security. Unfortunately, livestock farming faces many constraints, including climate (drought and aridity), poor nutrition, diseases that lead to more economic losses. To this end, traditional practices can provide effective support and an alternative natural way to treat various livestock diseases by improving animal health. The present study aimed to document the medicinal plants commonly used in ethnoveterinary medicine practices in several localities with breeders and veterinarians to treat various livestock diseases in the Naama region. The results obtained highlight the use of medicinal plants in traditional medicine for the care and treatment of animal diseases, allowed us to identify 21 medicinal plants belonging to 14 botanical families, dominated by the presence of *Amarantaceae* followed by *Asteraceae*, *Zygophyllaceae* and *Poaceae*. Among these plants, *Juniperus phoenicea* which treats mastitis and *Hammada scoparia* which treats various poisonings, *Allium sativum* to treat wounds and *Stipa tenacissima* is used against diarrhea. The most used parts of the plants are respectively the leaves 27.77%, the stems 19.44% and the seeds 16.66%. The preparation of the different organs is done by: decoction 25%, infusion 25% and maceration 12.5%. The breeders use these plants with imprecise doses (approximately a handful of green or dried leaves in 1 liter of water). The variation in the use of medicinal plants is linked to the profile of the breeders surveyed, the elderly use traditional remedies much more than the young and the vast majority of users of medicinal plants have an illiterate and primary

level. The results of the survey of veterinarians show that the majority have more than 10 years of experience (66.66%). Among the causes of the disease, are directly related to the environment (climate) and physical impurities. The consultation is made directly on site when the disease appears. Nine diseases were cited, the most common of which are bacterial diseases 36.48%, the most commonly reported of which those are directly affecting the digestive system 31% and respiratory 29.21%. Respiratory diseases (particularly of the alveolar sacs and sinuses) are important in our conditions where aridity is high and require constant monitoring measures. Veterinary remedies play an important role in the treatment of pathologies in animals and seem well known among breeders. This study showed the recourse of breeders to the use of pharmaceutical products compared to traditional products, because of the disappearance and degradation of species with medicinal interest. This current ethno-veterinarian study presents an alternative method and solution to their animal health problems. It presents the involvement of the local population of the Naama region in the conservation of popular know-how in traditional medicine despite the low percentage of users. This popular knowledge, considered as a heritage, can constitute a platform for the exchange of experiences, knowledge and information concerning the traditional use of medicinal plants. This knowledge is essential for future generations to be able to properly treat their domestic animals through scientific implementation. Indeed, the valorisation of these species with a pharmacological nature requires the research of their effectiveness through phytochemical and pharmacological studies. Thus, more in-depth chemical research to determine the minimum inhibitory concentrations, biological activities and toxicities, better use and better conservation of the use of the reported indigenous species should be considered for future work.





## 7 ACKNOWLEDGMENTS

We thank all the breeders and veterinarians for their welcome, their help and support throughout the duration of the completion of

this work. In particular, the veterinarian Dr Benameur Abderrahmane.

**Conflict of interests:** The authors have not declared any conflict of interests.

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