Punjab University Journal of Zoology

OPEN ACCESS

40(2): 127-138 (2025)
https://dx.doi.org/10.17582/journal.pujz/2025/40.2.127.138

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Research Article

Ethnoveterinary Use of Medicinal Plants by Domestic Animals in Rural Areas of Madhesh Province, Nepal

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Article History
Received: January 11, 2025
Revised: June 20, 2025
Accepted: July 01, 2025
Published: October 01, 2025

Authors' Contributions
SKS, and MK conceived, presented the idea and perform the experiment. SMST and AZK develpoed the theory. SMK and AMC verified the analytical methods. SS wrote the manuscript with the help of other authors.

Keywords
Herbal medicine, Traditional healers, *Cannabis sativa*, *Zingiberaceae,* Pharmaceutical interventions

Abstract | Traditional ethnoveterinary is at risk of disappearing due to the many changes that occur throughout the world, with Nepal not an exception. The knowledge should be documented for conservation, sustainable use, and development as much as possible. Thus, a study was done to investigate the herbal veterinary practices carried out in three different districts of Madhesh Province, viz. Siraha, Dhanusha and Mahottari in Nepal. Data collection was done through face-to-face interviews using the pre-tested questionnaire. Our findings documented the using of 35 plant species to treat different types of diseases and disorders in animals. The majority of medicinal plants belonged to *Zingiberaceae* (3 plants), followed by *Amaryllidaceae* (2 plants), *Annonaceae* (2 plants), *Apiaceae* (2 plants), *Fabaceae/ Leguminosae* (2 plants) and *Lamiaceae* (2 plants). The plant parts used were leaf, seed, fruit, and bark. We found that most of the medicinal plants were trees (42.8%, 15/35), herbs (40%, 14/35) and shrubs (8.6%, 3/35). The most common route of administration of the medicinal plant was the oral route followed by the dermal and ocular route. In the study area, ethnoveterinary practice was frequently used and well-understood by livestock farmers. The government and local people should implement conservation efforts and invest in research on medicinal plants.

Novelty Statement | This study explores the traditional knowledge and practices of ethnoveterinary medicine, which remain largely undocumented in the rural communities of Madhesh Province, Nepal. It provides novel insights into locally available medicinal plants used by farmers and healers for treating livestock ailments. Scientifically validating this indigenous knowledge, the research offers potential for developing affordable, culturally accepted, and sustainable veterinary treatments.

To cite this article: Singh, S.K., Khan, M., Tajmir, S.M.S., Khan, A.Z., Khan, S.M., Chaudhary, A.N. and Singh, S., 2025. Ethnoveterinary use of medicinal plants by domestic animals in rural areas of Madhesh province, Nepal. *Punjab Univ. J. Zool.*, **40**(2): 127-138. https://dx.doi.org/10.17582/journal.pujz/2025/40.2.127.138

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Introduction

In addition to being used as forage or feeding animals, plant species contribute significantly to the treatment of different diseases in human s and livestock animals. In rural areas, medicinal plants are easily available, the majority are inexpensive, effective, and cure a multitude of diseases (Dhakal *et al.*, 2021). The tribal and rural populations of Bangladesh, China, India, Nepal, and Vietnam, as well as South Korea and Japan, since ancient time s, practice traditional medicine and plants to treat a variety of illnesses, several studies have been conducted in these regions (Aziz *et al.*, 2018). Advanced knowledge and complicated technology are not required for its preparation and use at the farmer level. These medicinal plants also act as a source of drugs or their precursors for pharmaceutical companies (Sofowora *et al.*, 2013). Ethnoveterinary practice is widely prevalent and refers to skills, beliefs, knowledge, culture, and practices related to the cure of animal health using locally available plants (McCorkle, 1986). Ethnoveterinary practices play a vital role as a healthcare solution for domestic animals in every communiti (Phondani *et al.*, 2010). Although chemical anthelmintic medications are still used, their restricted use is mostly due to public health concerns and the development of resistance. Many parasites are resistant to chemical anthelmintic medications, and their use may soon be rendered ineffective. Alternatives to chemical antiparasitic medications are desperately needed (Al-Hoshani *et al.*,2024). They constitute a therapeutic property that is an alternative to chemical drugs (Klemow *et al.*, 2011). It is important to recognize, however, that herbal medicines, can have unexpected adverse reactions or interact negatively with other therapies. These effects can vary in severity and appearance in different animal species (Byard and Musgrave, 2021; Khan *et al.*, 2024). As a result, it is critical to use with caution. In many places, due to the absence of advanced animal health services, technicians, expensive medicine, cost of veterinary services, and better curing properties of herbal remedies against different diseases have encouraged many farmers to choose traditional ethnoveterinary medicine for a long period of time (Gobvu *et al.*, 2023; Zhang *et al.*, 2024).

In South Asia including Nepal, well known for its rich cultural diversity and distinctive ethnomedicinal practices, the utilization of conventional remedies to mitigate animal diseases is of integral significance within rural livelihoods (Uprety *et al.*, 2022). Despite the advancement seen in veterinary practices and the accessibility of pharmaceutical interventions, the endurance of ethnoveterinary knowledge and practices remains steadfast within the Nepalese community. In general, ethno-veterinary practices are widely used in Nepal to address minor veterinary diseases, prior to seeking professional veterinary assistance (Dhakal *et al.*, 2021). However, ancestral knowledge about ethnoveterinary practices is at risk of depletion due to evolving socioeconomic dynamics, rural-to-urban migration, and shifts in cultural values and the indigenous practices of livestock is gradually decreasing in these region (Phondani *et al.*, 2010; Chen *et al.*, 2016). Despite the rich flora and plants in Madhesh Province, systematic documentation and scientific validation of medicinal plant use for treating domestic animals remain limited. There is a lack of extensive studies exploring the effectiveness, safety, and sustainability of these traditional practices. Herbal products have been used as therapeutic agents since centuries. Modern studies proved antibacterial, antiviral, antiparasitic and anti-inflammatory effects of various plants (Al-Hoshani *et al.*, 2024).

The condition of wild medicinal plant species is also experiencing a decline primarily due to excessive exploitation, deterioration of habitats, and the encroachment of invasive species (Howes *et al.*, 2020; Kunwar *et al.*, 2016). Considering the significance of ethnoveterinary practices in rural Nepal and the pressing issues affecting medicinal plant species, this study aims to provide a comprehensive documentation of traditional practices used by farmers in Mahottari, Siraha, and Dhanusha districts. By capturing the detailed ethnobotanical knowledge and the specific medicinal plants utilized in the treatment of animal ailments, this research seeks to preserve and highlight the invaluable traditional knowledge that supports livestock health in these communities. The findings will contribute to a deeper understanding the mode of application of the herbal medicine in local practices, support the conservation of medicinal plant species, and potentially inform more sustainable approaches to veterinary care in rural settings. Furthermore, it looks for assess the socio-cultural significance of these practices and focus on the need for conservation and scientific validation of traditional knowledge

Materials and Methods

Study area

The study was carried out in the Siraha, Dhanusha, and Mahottari district of Madhesh province of the Terai region of Nepal (Figure 1). Madhesi are the inhabitants of the Terai region in the south of Nepal, and these districts lie open to the border with India. These districts in the Terai region are unique from the rest of the country due to their plain land with a subtropical climate. Different madhesi ethnic groups having Maithili, Bhojpuri, Awadhi, and Hindi lingual attributes are densely found in these study areas.

Data collection

Data collection was carried out using pretested questionnaires. It was prepared by investigators based on their knowledge and previous studies (Acharya and Acharya, 2010; Bhattarai, 2018; Gakuubi and Wanzala,

2012). Purposively 80 individuals from three districts (Mahottarai: 25, Siraha: 30 and Dhanusha: 25) were selected from July 5 to September 3, 2019, possessing regular ethnoveterinary usage, and experience in domestic animal rearing (10+ years). It was made sure that these individuals had a background in using traditional plant-based veterinary practices and gave verbal consent to participate in survey. The next respondent to be interviewed was selected as suggested by the previous respondent qualifying the above-mentioned criteria. Face-to-face interviews were conducted to systematically collect ethnoveterinary practice and information.

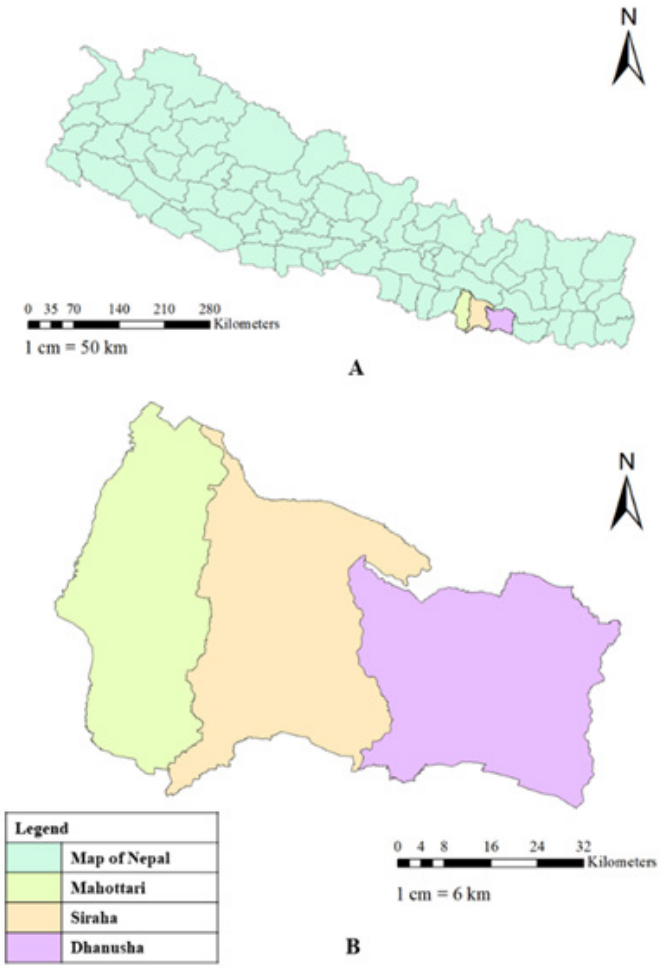

Figure 1: (A) Map of Nepal showing the study district. (B) Map of the study district, viz. Mahottari, Siraha, and Dhanusha. Source of shape file used in Arc Gis Ver. 10.8: https://opendatanepal.com/dataset/new-political-and-administrative-boundaries-shapefile-of-nepal

Collection and identification of plant specimens

Most of the collected specimens were recognized on-site, while others were distinguished through consultations with consulting local botanical experts and cross-referenced with standard herbarium (Group, 1998). The nomenclature and classification of the identified species were done using different references (Aryal *et al*., 2016; Nepal, 2000; POWO, 2017; Shrestha *et al*., 2018; WFO, 2023a, b).

Data organization

As soon as data collection was completed, data entry was performed using Microsoft Excel 2016. Medicinal plants identified were classified according to their life forms- herbs, shrubs, trees, and climbers as generally done by other researchers. The specific plant parts used were classified into different categories such as bark, bulb, flower, fruit, leaf, rhizome, root, seed, and stem. Similarly, the routes of administration were classified as oral, dermal (applied to the skin), and ocular (applied to the eyes).

Results

Plant diversity and uses

Ethnoveterinary practice is used by local farmers for treating animal diseases. A total of 35 medicinal plants were identified (Table 1). Most of the plants belonged to Zingiberaceae (3 plants), followed by Amaryllidaceae (2 plants), Annonaceae (2 plants), Apiaceae (2 plants), Fabaceae/ leguminosae (2 plants), Lamiaceae (2 plants) and Meliaceae family (2 plants). The family and their number of plants are presented in (Supplementary Table S1).

Plant parts used, life forms, and route of administration

We found the leaf of the plant was the main part of the plant used to prepare medications. The use of leaf was followed by seeds, fruits, bark, roots, flowers, etc. (Table 2). Similarly, most of the medicinal plants were trees (15 plants), followed by herbs (14 plants), shrubs (3 plants), and climbers (3 plants) (Figure 2). The oral route of administration of medicinal plants was the most used, followed by the dermal and ocular routes (Figure 3).

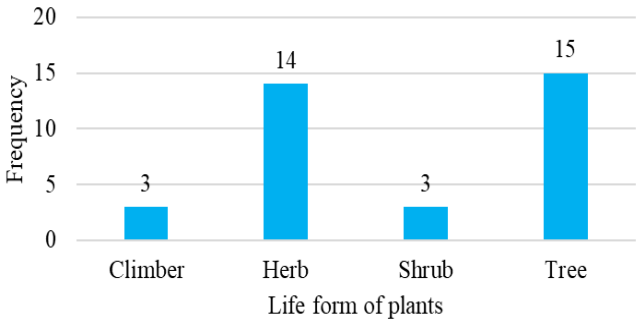

Figure 2: Life form of medicinal plants in the study area and their respective frequencies.

Discussion

Raising livestock is crucial to subsistence farmer s and supports the livelihoods of Nepalese farmers. For them, the application of ethnoveterinary practice using plant species is a significant component for the treatment of a variety of diseases in domesticated animals. So, the medicinal plants and preparation techniques used in ethnoveterinary practice must be documented.

Table 1: Ethno-veterinary plants profile and their applications in animal treatments.

ID	Local name	Common name	Binomial name	Family	Life form	Useful parts	Route	Uses
VS#1	Chirchiri	Chaff flower	*Achyranthes aspera* L	Amaranthaceae	Herb	Root, Leaf	Oral	Purgative, cough, diuretic, dropsy, piles, stomach ache, piles
VS#2	Bel	Bel	*Aegle marmelos* (L.) Corrêa	Rutaceae	Tree	Fruit, Root, Leaf	Oral	Fever, laxative, dyspepsia, astringent, against dysentery
VS#3	Piyaj	Onion	*Allium cepa* L.	Amaryllidaceae	Herb	Leaf, Bulb	Dermal, Oral	Inflammatory swelling on skin due to insect and scorpion, demulcent for skin diseases. It is used along with Mustard oil
VS#4	Lahsun	Garlic	*Allium sativum* L.	Amaryllidaceae	Herb	Bulb	Oral	Diarrhea, dysentery, typhoid, cholera, bacterial food poison
VS#5	Ghirt Kumari	Aloe vera	*Aloe vera* (L.) Burm.f.	Asphodelaceae	Herb	Leaf	Dermal, Oral	Wound healing, gastritis
VS#6	Ramfal	Wild sweetsop	*Annona reticulata* L.	Annonaceae	Tree	Leaf	Dermal	Used in maggot wound
VS#7	Sarifa,Sitafal	Custard apple	*Annona squamosa* L.	Annonaceae	Tree	Leaf, Bark, Seed	Dermal, Oral	Wound healing, cough, lice infestation, along with tobacco used to treat maggot wound and skin infections
VS#8	Badahar	Monkey jack fruit	*Artocarpus lacucha* Buch-Ham. ex D.Don	Moraceae	Tree	Seed, Bark	Oral, Dermal	Purgative, dysentery and arthritic swelling, in liver and stomach ailments
VS#9	Shatawari	Asparagus	*Asparagus racemosus* Willd.	Liliaceae	Climber	Root, Leaf	Oral	Mastitis and increase milk production
VS#10	Neem	Neem	*Azadirachta indica* A. Juss.	Meliaceae	Tree	Leaf, Bark, Flower, Seed	Oral, Dermal	Skin infections like itching, ringworm, scabies, mange. Moreover, used as an astringent, cough, asthma, anthelmintic, removes cough, biliousness, toothache
VS#11	Simal	Silk cotton tree	*Bombax ceiba* L.	Malvaceae	Tree	Root, Bark, Flower	Oral	Emetic, digestion stimulant, tonic, remove the placenta
VS#12	Bhang	Bhang	*Cannabis sativa* L.	Cannabaceae	Herb	Leaf, Seed	Oral	Tonic, intoxicant, stomachic, antispasmodic, analgesic, promote sleep, diarrhea and dysentery
VS#13	Patrak, Tejpata	Indian bay leaf	*Cinnamomum tamala* (Buch.-Ham.) T. Nees and Eberm.	Lauraceae	Tree	Leaf, Bark	Oral	Rheumatism, colic, diarrhea, nausea and vomiting.
VS#14	Hardi, Haldi	Turmeric	*Curcuma longa* L.	Zingiberaceae	Herb	Rhizome	Dermal, Oral	Wound healing, cough and pneumonia
VS#15	Sisso	Sissam	*Dalbergia sissoo* DC.	Fabaceae	Tree	Leaf	Oral	Bloody diarrhea, dysentery and babesiosis
VS#16	Elaichi	Cadamom	*Elettaria cardamomum* (L.) Maton	Zingiberaceae	Herb	Seed	Oral, Ocular	Stomachic, neuralgia, oil applied to eye lids to reduce inflammation
VS#17	Hing	Asafoetida	*Ferula asa-foetida* L	Apiaceae	Herb	Rhizome	Oral, Dermal	Flatulence, colic, indigestion, cough, bronchitis, asthma, and wound.
VS#18	Mehadi	Henna	*Lawsonia inermis* L.	Lythraceae	Shrub	Leaf	Dermal	Burn and skin infections
VS#19	Bakain	Bead-tree	*Melia azedarach* L.	Meliaceae	Tree	Leaf	Dermal, Oral	Intestinal worm
VS#20	Pudina	Mint	*Mentha spicata* L	Lamiaceae	Herb	Leaf	Oral	Used to smooth upset stomach, reduce gas, and stave off nausea and motion sickness

Table continues on next page.....

ID	Local name	Common name	Binomial name	Family	Life form	Useful parts	Route	Uses
VS#21	Sohijan	Moringa	*Moringa oleifera* Lam.	Moringaceae	Tree	Seed	Oral, Dermal	Wound healing, indigestion, anti-inflammatory, antipyretic
VS#22	Tulsi	Tulsi	*Ocimum tenuiflorum* L.	Lamiaceae	Shrub	Leaf	Oral	Wound healing, stomachic, anthelmintic, antiseptics, antipyretic, lung infection
VS#23	Amloki, Dhatri, Rikhiya	Gooseberry	Phyllanthus emblica L.	Phyllanthaceae	Tree	Fruit, Seed, Root	Oral	Anti-flatulence, appetizer, stomachic, digestant, immunomodulator, astringent, asthma, bronchitis, and biliousness
VS#24	Pipli	Long pepper	*Piper longum* L.	Piperaceae	Climber	Fruit	Oral	Anti-flatulence, anti-inflammatory, analgesic, pneumatic pains, bronchitis, appetizer
VS#25	Sarpgandha	Sarpentine	*Rauvolfia serpentina* (L.) Benth. ex-Kurz	Apocynaceae	Shrub	Root, Seed, Leaves	Oral	Anti-hypertensive and sedatives remedy in painful affections of the bowels, during pregnancy to increase uterine contractions
VS#26	Anadi	Castor oil plant	*Ricinus communis* L.	Euphorbiaceae	Tree	Seed, Fruit, Flower, Leaf	Oral	Skin inflammation, indigestion, constipation, impactions, pains, ascites, fever, arthritis, and rheumatism, intestinal worms, night blindness
VS#27	Ukhu	Sugarcane	*Saccharum officinarum* L.	Poaceae	Herb	Leaf	Oral	Retention of placenta and parturition initiator
VS#28	Rittha	Indian soap berry	*Sapindus mukorossi* Gaertn.	Sapindaceae	Tree	Fruit	Oral	Expectorant, used in excessive salivation and chlorosis
VS#29	Chiraita	Chirreta	*Swertia alata* C.B. Clarke	Gentianaceae	Herb	Flower, Stem	Oral	Used as tonic, stomachic, laxative, anti-inflammatory and anti-diarrheal
VS#30	Jamun	Java plum	*Syzygium cumini* (L.) Skeels.	Myrtaceae	Tree	Fruit, Bark, Seed, Leaf	Oral	Astringent, anthelmintic, useful in diarrhea, dysentery, bronchitis, asthma, blood impurities, ulcers, carminative, diuretic, diabetes
VS#31	Harre	Myrobalan	*Terminalia chebula* Retz.	Combretaceae	Tree	Fruit	Oral	Constipation, bloat
VS#32	Gurguj	Heart leaved moonseed	*Tinospora cordifolia* (Willd.) Miers	Menispermaceae	Climber	Leaf	Oral	Stomachic, antipyretic, diuretic, diarrhea, dysentery, febrifuge and urinary tract infections
VS#33	Ajawain	Thymol seeds	*Trachyspermum ammi* (L.) Sprague	Apiaceae	Herb	Flower, Seed	Oral	Bloat, indigestion and digestive stimulants
VS#34	Mas dal	Black gram	*Vigna mungo* (L.) Hepper	Fabaceae	Herb	Seed	Oral	Repeat breeding, fracture, digestive disorder
VS#35	Aadi, Adarak	Ginger	*Zingiber officinale* Roscoe	Zingiberaceae	Herb	Rhizome	Oral	Fever, indigestion, helminthiasis, bloat, calf scours, wheezing, and tuberculosis

Different researchers have conducted ethnobotanical studies in Nepal to document the use of medicinal plants for the treatment of animal ailments (Acharya and Acharya, 2010; Dhakal *et al*., 2021; Gyawali and Paudel, 2017; Raut and Shrestha, 2012). Contrary to our study, Dhakal *et al*. (2021) found Fabaceae, Raut and Shrestha (2012) found Liliaceae, Mehalingam and Sam Shirley (2011) found Euphorbiaceae, Khan *et al*. (2021) found Polygonaceae, Babacan *et al*. (2022) found Astereceae, Prakash *et al*. (2021) found most of the plant species were Rosaceae. This difference might be due to geographical location. Furthermore, we cannot omit differences in cultural and traditional beliefs compared to our study area.

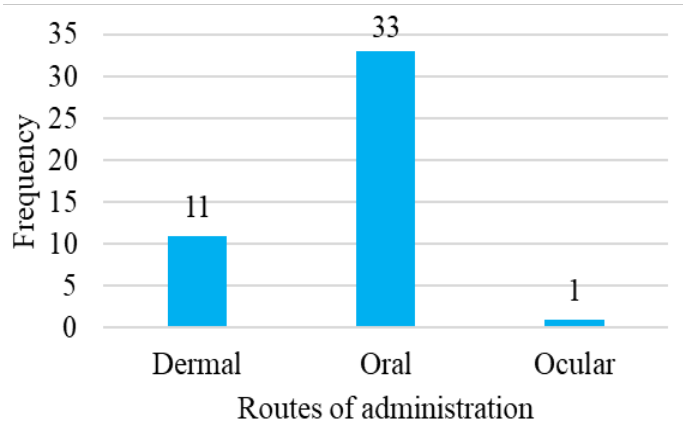

Figure 3: Route of administration of medicinal plants and their frequencies.

Table 2: Frequency of plant parts used for different ailments.

Plant parts	Frequency
Leaf	20
Seeds	12
Fruits	7
Bark	6
Root	6
Flower	5
Rhizome	3
Bulb	2
Stem	1

The use protocol differed according to farmers. The findings that the leaf was used extensively for the preparation of the remedies are similar to the findings of other similar studies (Dhakal *et al.*, 2021; Güler *et al.*, 2021; Kamatchi and Parvathi, 2020; Mehalingam and Sam Shirley, 2011; Prakash *et al.*, 2021). But, Raut and Shrestha (2012) found seeds, Khan *et al.* (2021) found roots, Acharya and Acharya (2010) found whole plants as the most used plant parts. The leaves can be collected easily in comparison to other plant parts and this may be one of the reasons for their frequent use in our study. Furthermore, leaves actively participate in photosynthesis and metabolites formation (Ghorbani, 2005). Thus, their wide range of constituents may explain their effectiveness in the treatment of a variety of diseases in both people and animals. As long as some leaves are left on the parent plant, the collection of leaves for herbal remedies could be considered sustainable from a conservation standpoint (Yineger *et al.*, 2007). The fact that roots persist in the soil and are freely available even during prolonged dry seasons in arid and semi-arid regions may explain why other researchers found roots to be the most often used plant part (Getaneh and Girma, 2014). The collection of roots can be hazardous to plants and could lead to the loss of plant species, so this must be taken into account (Moyo *et al.*, 2015).

Furthermore, the life forms of the medicinal plants indicated that most of them were trees, which is similar to the findings of Kamatchi and Parvathi (2020). However, herbs were the main growth form of medicinal species in other studies (Bharati and Sharma, 2012; Mehalingam and Sam Shirley, 2011; Prakash *et al.*, 2021; Rafique Khan *et al.*, 2021). Similarly, Acharya and Acharya (2010) found climbers as a dominant life form. This could potentially be attributed to the convenience of collecting, storing, extracting, and transporting them compared to other life forms. Herbs are frequently used because of their widespread availability, simplicity in collecting, and use.

Oral administration was common, as in Raut and Shrestha (2012) study. They also found the nasal route of administration, but it was not found in our study. Oral delivery is a simple and noninvasive method of systemic therapy. The method enables quick absorption and distribution of prepared medications as well as the delivery of adequate curative power (Teklay *et al.*, 2013).

The traditional medicinal use of some documented medicinal plants is recorded in other studies, too. Unlike our finding, the use of *Achyranthes aspera* was thought to accelerate the expulsion of the placenta, cure endo-parasites, and ease delivery (Dhakal *et al.*, 2021; Raut and Shrestha, 2012). *Aegle marmelos* was used to treat gastrointestinal disorders such as indigestion, bloat, and fever (Saini *et al.*, 2022). Similarly, *Allium cepa* was used in flatulence and dysentery (Dixit and Vakshasya, 2019), for galactagogue, indigestion, stomach disorder and fever (Abbasi *et al.*, 2013). *A. cepa* has shown action against nematodes, *Salmonella typhi*, *Candida albicans*, and *Staphylococcus aureus* (Qamar *et al.*, 1998; Srinivasan *et al.*, 2001). Moreover, *Allium sativum* was used for genital prolapse (Dilshad *et al.*, 2008).

In our study, *Aloe vera* was used for wound healing and gastritis. The alcoholic and aqueous extracts of this plant have demonstrated a notable action against *Salmonella typhimurium*, *Bacillus subtilis*, *Escherichia coli*, *Proteus vulgaris*, *Pseudomonas aeruginosa*, and *Staphylococcus aureus* (Ahmad *et al.*, 1998; Flessner, 2006; Sweelam, 1989). Nirmal *et al.* (2010) found that the ethanol extract derived from *Annona reticulata* leaves demonstrates notable anthelmintic activity. Similarly, to our findings, Pande *et al.* (2007) also reported *Annona squamosal* was used to destroy maggots. *Artocarpus lacucha* was used for treating mouth infections (Bhat *et al.*, 2023). The application of *Asparagus racemosus* resonate with the findings of researches (Acharya and Acharya, 2010; Dhakal *et al.*, 2021; Raut and Shrestha, 2012), where they report it was used for the stimulation of lactation, mastitis, and bone-related problems. The medicinal use of *Azadirachta indica* to treat endoparasites, ectoparasites, wounds, and skin infections was also documented by other researchers (Bhat *et al.*,

2023; Dhakal *et al*., 2021; Dixit and Vakshasya, 2019; Raut and Shrestha, 2012). The plant has a bioactive compound such as Azadirachtin, nimbin, sodium nimbinate, salannin, and quercetin (Alzohairy, 2016).

Bombax ceiba was used as emetics, digestion stimulant, and placenta. Dhakal *et al*. (2021) have also reported similar types of use for constipation, dysentery, removal of the placenta, cuts, and wounds. Similar to this study, Abbasi *et al*. (2013) found it to be used for appetite stimulants, abdominal swelling, and indigestion. In addition, it has also been used for the treatment of leeches and lice (Abbasi *et al*., 2013), genital prolapse (Dilshad *et al*., 2008), anthelmintic, diarrhea, dysentery, cough, cold, and urinary problems (Dhakal *et al*., 2021; Gyawali and Paudel, 2017; Raut and Shrestha, 2012). In human applications, *C. tamala* leaves were used to treat gastic problems (Gyawali and Paudel, 2017). *Curcuma longa* was used for the treatment of mastitis, wounds, and joint pain (Saini *et al*., 2022). Likewise, *Dalbergia sissoo* was found to be used for treating constipation (Abbasi *et al*., 2013). In this study, it was used to treat bloody diarrhea, dysentery, and babesiosis. The combination of these plants *Acacia nilotica* (L.) Delile, *Ficus bengalensis* L., and *Dalbergia sissoo* were used for genital prolapse (Dilshad *et al*., 2008). *Elettaria cardamomum* was used to treat fever (Dhakal *et al*., 2021; Nawaz *et al*., 2024).

We found that the application of *Ferula assafoetida* was for the treatment of flatulence, colic, indigestion, cough, bronchitis, asthma and wounds. Dilshad *et al*. (2008) found it to be used for treating silent estrus. It was also used as an analgesic and for stomachaches in combination with *Zingiber officinale* and *Citrus reticulata*. In disagreement with our findings, *Lawsonia inermis* leaves were used for genital prolapse (Dilshad *et al*., 2008; Tanveer *et al*., 2021). *Melia azedarach* was used for the treatment of intestinal worms. In contrast to our findings, it was used for foot and mouth infections, skin infections, rashes, gas trouble, indigestion, flatulence, and snake bites (Abbasi *et al*., 2013; Hassan *et al*., 2014). However, some research reported that it was used for genital prolapse and as a cooling agent (Ali, 1999; Dilshad *et al*., 2008; Wang *et al*., 2024). Ranjana *et al*. (2014) found that *Mentha spicata* was used to treat diarrhea and dysentery. Bark of *Moringa oleifera* together with *Allium sativum*, rendered soluble in water, was applied in a layer over a hen farm for repelling hen lice (Soren *et al*., 2021). Similarly, to our study, *Ocimum tenuiflorum* was used to treat gastrointestinal disorders like constipation (Saini *et al*., 2022; Sohail *et al*., 2021).

Unlike what we reported, *Phyllanthus emblica* was used for fever, cough, and anthrax (Bhat *et al*., 2023). It is thought to have bioactive compounds such as tannins, flavonoids, saponins, terpenoids, alkaloids, and ascorbic acid, etc (Saini *et al*., 2022). Pande *et al*. (2007) reported use of *Piper longum* for internal injury, contusion, bruises, and wounds. According to Singh and Sureja (2007), *Rauvolfia serpentine* was used to treat loose motion. Similar to ours, *Ricinus communis* seed oil was administered to treat constipation and skin infection (Abbasi *et al*., 2013; Saini *et al*., 2022). *R. communis* has also been used in other places to treat intestinal obstruction, foot problems, digestive problems, wounds, abscesses, to remove retained placentas, and for cattle experiencing quiet estrus or delayed puberty (Ali, 1999; Dilshad *et al*., 2008; Lans *et al*., 2006). This plant contains various bioactive compounds such as Ribitol, 3-ethoxy-1, 2-propanediol, p-dioxane-2, dodecanoic acid, cetene, geranyl isovalerate, phenol, etc. (Hussein *et al*., 2018). According to McGaw *et al*. (2007), steam and leaf of *R. communis* have hexane extract, which is effective against *Staphylococcus aureus*, *Enterococcus faecalis*, *Pseudomonas aeruginosa*, and *Escherichia coli*.

Dhakal *et al*. (2021) found *Saccharum officinarum* was used to remove the placenta and also to increase milk production. Differently from our findings, *Sapindus mukorossi* was used to expel leach, external parasites, and allergy in hen (Pande *et al*., 2007). In human application, Bhatt *et al*. (2007) reported that infusion of *Swertia alata* was used as a tonic and febrifuge. Abbasi *et al*. (2013) reported *Syzygium cumini* was used to treat diarrhea and dysentery, the same as we reported. Unlike our documentation, *Terminalia chebula* was used for skin infection, rickets, and diarrhea (Pande *et al*., 2007). *Tinospora cordifolia* was used to cure sterility, appetite loss, constipation, and diarrhea (Bhattarai and Acharya, 2015; Dhakal *et al*., 2021; Mehalingam and Sam Shirley, 2011). *Trachyspermum ammi* was used in the treatment of abdominal pain, swelling, and indigestion, as an appetite stimulant, and as a galactagogue (Abbasi *et al*., 2013). The most frequent some infectious diseases and disorder treated ailments were anthrax with 18 species (28.13%), followed by inappetence (15 species, 23.44%), diarrhoea (13, 20.31%), rabies (12, 18.75%), bloating (11, 17.19%), blackleg and mange (10, 15.63%) each (Oda *et al*., 2024).

Quite similar to our findings, *Vigna mungo* was used in bone fractures, to regulate fertility, lactation, strength, retention of placenta, and food poisoning (Khan *et al*., 2025; Pande *et al*., 2007). Similarly, *Zingiber officinale* was also used for indigestion (Bhat *et al*., 2023). Wide application of *Zingiber officinale* for diarrhea, mastitis, wounds, and cough was also reported (Dhakal *et al*., 2021; Gyawali and Paudel, 2017).

In our study area, these recipes prepared from medicinal plates were given to the cattle along with their feed and various substances such as flour, oil, sugar, milk, etc. Similar to ours, other parts of the world have also observed similar results (Offiah *et al*., 2011; Tariq *et al*., 2014; Ullah *et al*., 2021). According to Poonam and Singh (2009), the

Kani traditional healers of India used enhancers such as honey, cow or goat milk, sugar, ghee, salt, cooked rice, and buttermilk to enhance flavor and medicinal properties. The adoption of these means of transportation may be due to their ability to enhance the flavor and therapeutic effects of specific plant treatments. However, because there is no single known unit of measurement for plant treatments, dosage estimation was a major issue in the study area. The dose regimen was often based on the severity and duration of the disease, the age of the animal, and its physical condition. The complete recovery was known by the disappearance of clinical manifestations and when the animals resumed normal food and activity.

Conclusions

A total of 35 plant species from which farmers prepare medicine to cure various diseases of domestic animals were documented. The Terai region is rich in flora and forests, so further investigations covering many districts may be vital. The farmers had a good knowledge and practices of ethnoveterinary medicine. There is an urgent need to validate and document traditional plants and their knowledge, practice, and local resources for the development of livestock sector. Conservation initiatives should be implemented at the government level. It is important to support this assertion with pharmacological evaluation through phytochemical studies. So, there is a pressing need for extensive experimental research into the utilization of medicinal plants and animals to address animal ailments.

Declarations

Acknowledgement

Authors would like to acknowledge Department of Veterinary Surgery, Medicine, Epidemiology and Public health, Institute of Agriculture and Animal Science, Tribhuvan University, Paklihawa Campus, Bhairahawa, Nepal for providing support in this study.

Funding

This research did not receive a specific grant from any funding agency in the public, commercial, or non-profit sectors.

IRB approval

Not applicable

Ethical statement

Not applicable

Informed consent statement

Individual's consent was received prior to data collection.

Data availability statement

The data used to support the findings of this study are available from the corresponding author upon reasonable request.

Declaration of generative AI and AI-assisted technologies in the writing process

No Generative AI and AI-assisted technologies wer used in the writing process.

Conflicts of interest

The authors have declared no conflict of interest.

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Supplementary Material

Supplementary Table S1: Family of medicinal plants and the number of identified plants.

Family	Number of plants
Amaranthaceae	1
Amaryllidaceae	2
Annonaceae	2
Apiaceae	2
Apocynaceae	1
Asphodelaceae	1
Cannabaceae	1
Combretaceae	1
Euphorbiaceae	1
Fabaceae/ Leguminosae	2
Gentianaceae	1
Lamiaceae	2
Lauraceae	1
Liliaceae	1
Lythraceae	1
Malvaceae	1
Meliaceae	2
Menispermaceae	1
Moraceae	1
Moringaceae	1
Myrtaceae	1
Phyllanthaceae	1
Piperaceae	1
Poaceae	1
Rutaceae	1
Sapindaceae	1
Zingiberaceae	3