

Ethnoveterinary knowledge and its role in sustainable livestock production

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Journal of Livestock Science (ISSN online 2277-6214) 17: 879-885

Received on 29/10/25; Accepted on 7/10/26; Published on 10/10/26

doi. 10.33259/JLivestSci.2026.879-885

Abstract

This study documents and analyses ethnoveterinary practices (EVP) prevalent in Bihar, India, with the aim of preserving traditional livestock healthcare knowledge and exploring its role in sustainable animal husbandry. A multi-stage purposive sampling technique was used to select 15 districts, 20 blocks, and 25 villages, from which 50 respondents, including traditional healers and livestock keepers, were interviewed. Data were collected through personal interviews and focus group discussions, focusing on plant-based remedies, methods of preparation, and community perceptions. A total of 50 ethnomedicinal plant species were recorded, employed in the treatment of digestive, reproductive, respiratory, infectious, and other livestock ailments. Paste preparations (48%) were the most common form of application, and leaves (19 cases) were the most frequently used plant part. Digestive disorders emerged as the most frequently treated category, followed by reproductive disorders. The findings underscore the rich repository of indigenous knowledge in Bihar, highlighting the accessibility, affordability, and eco-friendliness of these practices. The study emphasizes the importance of scientific validation, conservation of traditional wisdom, and its potential integration with modern veterinary medicine to enhance sustainable livestock production.

Keywords: Ethnoveterinary practices; Livestock health; Medicinal plants; Sustainable livestock production; Traditional knowledge

Introduction

Livestock rearing forms an integral part of rural livelihoods in Bihar, an eastern Indian state with a predominantly agrarian economy, rich cultural heritage, and strong community traditions. The livestock sector not only provides milk, meat, and draught power but also plays a crucial role in ensuring food security, employment generation, and socio-economic stability among smallholder and marginal farmers (Birthal & Negi, 2012). In such rural settings, where access to modern veterinary infrastructure is often limited, generations of livestock keepers have relied on indigenous knowledge systems, particularly ethnoveterinary practices (EVPs), to manage animal health.

Ethnoveterinary medicine refers to a set of traditional knowledge and practices related to animal health care, involving the use of medicinal plants, natural remedies, and community-specific techniques that are locally available, cost-effective, and ecologically sustainable. These practices, developed through centuries of experiential learning and close observation of animal behavior and ecology, represent a holistic approach to livestock management that integrates ecological knowledge, cultural beliefs, and practical utility (Yadav & Singh, 2014; Kennedy et al., 2019).

The significance of EVPs has gained renewed attention in recent decades due to modern challenges such as the escalating cost of veterinary pharmaceuticals, concerns over antimicrobial resistance, and the erosion of biodiversity linked to overdependence on synthetic drugs (WHO, 2019; Tiwari et al., 2020). In India, where nearly 70% of the rural population is engaged in agriculture and allied activities, reliance on ethnoveterinary knowledge remains particularly relevant for resource-poor households (Sundaresan et al., 2018). Despite this, systematic documentation and scientific validation of these practices remain limited, especially in Bihar, where rich biodiversity and cultural traditions suggest the presence of a vast, yet underexplored, ethnoveterinary pharmacopeia.

Against this backdrop, the present study was undertaken to document and critically analyze the ethnoveterinary knowledge systems prevalent in rural Bihar. Furthermore, recognizing and valuing the indigenous wisdom of Bihar's livestock keepers not only enhances animal health management but also aligns with global calls for inclusive, eco-friendly, and culturally sensitive approaches to rural development (FAO, 2021). The study was conducted with objectives; to document and characterize the ethnoveterinary practices involving medicinal plants and plant-based preparations used for the treatment and management of various animal diseases and health disorders in different agro-climatic regions of Bihar and to assess the diversity, methods of preparation and administration, perceived efficacy, and traditional knowledge associated with plant-based ethnoveterinary practices among local healers, traditional practitioners, and livestock-keeping communities in Bihar.

Materials and Methods

This study was undertaken in the state of Bihar with the primary objective of documenting and analyzing ethnoveterinary practices employed in the treatment of animals using various plants and plant-based extracts. A multi-stage purposive sampling technique was employed for the selection of study areas and respondents to ensure representation of diverse ecological and cultural contexts. In the first stage, 15 districts were purposively selected from different agro-climatic zones of Bihar to capture regional diversity in traditional animal healthcare practices. In the second stage, 20 blocks were selected from within these districts based on the prevalence and active use of ethnoveterinary knowledge. In the third stage, 25 villages were identified from the selected blocks, ensuring inclusion of both remote and accessible communities where traditional veterinary practices are still in use. From these villages, a total of 50 respondents were selected through purposive sampling. The respondents comprised local healers, traditional practitioners, and other key informants known for their indigenous knowledge and regular involvement in ethnoveterinary treatments.

To collect primary data, both personal interviews and focused group discussions (FGDs) were conducted. A semi-structured interview schedule guided the personal interviews, enabling an in-depth understanding of the plant species used, methods of preparation and application, and the perceived effectiveness of treatments. FGDs were conducted to validate and enrich the information gathered through interviews and to understand community perceptions and collective experiences related to ethnoveterinary practices. The collected data were systematically analysed using qualitative methods and descriptive statistical tools to extract meaningful insights and comprehensively document the traditional knowledge systems prevalent in the study areas.

Results

Diversity of Livestock Ailments Treated

The ethnoveterinary practices documented in Bihar reflect a strong reliance on plant-based remedies for managing livestock health problems. Among the ailments reported in fig.1, digestive disorders were the most frequently treated (12 cases), followed by reproductive disorders (10 cases) and infectious diseases (6 cases). Respiratory conditions, mastitis, and wound-related issues were also treated but to a comparatively lesser extent.

Preparation and Mode of Application

Fig. 2 indicated that, the remedies were prepared in multiple forms, with paste preparations being most common (48.00%), followed by powders (8.00%), extracts (4.00%), oils (4.00%), and other methods (36.00%).

The dominance of paste formulations highlights their practicality and easy to prepare using fresh plant material, directly applicable for topical use, or easily administered orally.

Table 1. Categorized Ethnoveterinary Plant Practices in Bihar

1A. Dermatological / External Conditions

S.N.	Botanical Name	Common Name	Family	Preparation & Use
1	<i>Blumea lacera</i>	Kukraundha	Asteraceae	Leaf juice applied for wound healing.
2	<i>Curcuma longa</i> + <i>Brassica nigra</i>	Turmeric + Mustard Oil	Zingiberaceae, Brassicaceae	Paste applied to udder to treat mastitis.
3	<i>Annona squamosa</i>	Custard Apple	Apocynaceae	Leaf paste applied on wounds & maggot infestations.
4	<i>Datura stramonium</i>	Datura	Solanaceae	Fresh fruit paste applied for wound healing.
5	<i>Cuscuta europaea</i>	Amarbel	Convolvulaceae	Paste applied on skin for infections.
6	<i>Piper betel</i>	Paan	Piperaceae	Leaves/paste fed for lumpy skin disease.
7	<i>Tinospora cordifolia</i>	Giloy	Menispermaceae	Stem paste applied on lesions of lumpy skin disease.
8	<i>Curcuma longa</i>	Turmeric	Zingiberaceae	Powder with camphor & coconut oil applied on lesions (LSD).
9	<i>Madhuca longifolia</i>	Mahua	Sapotaceae	Flowers + jaggery paste applied to udder for mastitis.
10	<i>Bauhinia variegata</i>	Kachnar	Fabaceae	Leaf paste applied to udder for mastitis.
11	<i>Madhuca longifolia</i>	Mahua seed oil	Sapotaceae	Used as spray to control ticks & mosquitoes.
12	<i>Opuntia spp.</i>	Cactus	Cactaceae	Paste applied on skin for dermal infections.
13	<i>Ficus virens</i>	Pakad	Moraceae	Leaf paste applied on skin for lumpy skin disease.
14	<i>Bombax ceiba</i>	Sembal	Malvaceae	Bark extract applied to wounds to relieve pain.
15	<i>Cuscuta reflexa</i>	Amarbel	Convolvulaceae	Decoction used for fomentation on wounds.
16	<i>Semecarpus spp.</i>	Bhelwa	Anacardiaceae	Burned seeds' oil applied on swellings.

1B. Digestive Disorders

S.N.	Botanical Name	Common Name	Family	Preparation & Use
1	<i>Datura stramonium</i>	Datura	Solanaceae	Fruits/seeds boiled with salt, made into paste, fed orally to treat diarrhea.
2	<i>Allium cepa</i> + <i>Piper nigrum</i>	Onion + Black Pepper	Amaryllidaceae, Piperaceae	Bulbs and seeds boiled, made into paste, fed orally to treat anorexia.
3	<i>Trachyspermum ammi</i> + <i>Curcuma longa</i>	Ajwain + Turmeric	Apiaceae, Zingiberaceae	Crushed with salt, paste fed to treat anorexia.
4	<i>Solanum virginianum</i>	Regani	Solanaceae	Leaves paste fed to treat rickets-like condition.
5	<i>Solanum melongena</i>	Brinjal	Solanaceae	Fruits fed for pyometra/placenta release; roasted fruit for diarrhea.
6	<i>Linum usitatissimum</i>	Linseed	Linaceae	Powder with jaggery fed for diarrhea.
7	<i>Saccharum officinarum</i>	Sugarcane	Poaceae	Fresh leaves fed to treat bloat.
8	<i>Sesamum indicum</i> , <i>Moringa oleifera</i> , <i>Cannabis sativa</i>	Sesame, Moringa, Hemp	Pedaliaceae, Moringaceae, Cannabaceae	Shade-dried leaves mixed, fed for diarrhea.
9	<i>Aloe barbadensis</i>	Aloe vera	Asphodelaceae	Gel solution fed for heat stress & fever.
10	<i>Phyllanthus emblica</i>	Indian Gooseberry	Phyllanthaceae	Fruits fed to treat tympani, diarrhea, and boost immunity.

1C. Reproductive Disorders

S.N.	Botanical Name	Common Name	Family	Preparation & Use
1	<i>Ficus racemosa</i>	Gular	Moraceae	Fruit powder with jaggery used to treat uterine prolapse.
2	<i>Dalbergia sissoo</i>	Shisham	Fabaceae	Leaves/paste fed to enhance conception or prevent diarrhea.
3	<i>Ficus religiosa</i>	Peepal	Moraceae	Leaves fed to aid placental removal post-parturition.
4	<i>Solanum melongena</i>	Brinjal	Solanaceae	Fruits fed for placenta release.
5	<i>Basella alba</i>	Malabar Spinach	Basellaceae	Leaves fed for placenta expulsion.
6	<i>Saccharum officinarum</i> + <i>Oryza sativa</i>	Sugarcane + Paddy	Poaceae	Fed to treat retention of placenta.
7	<i>Madhuca longifolia</i>	Mahua	Sapotaceae	Flowers fed for uterine retraction.
8	<i>Bambusa vulgaris</i>	Bamboo	Poaceae	Leaves and buds fed to regularize estrus and expel placenta.

1D. Infectious / Febrile Conditions

S.N.	Botanical Name	Common Name	Family	Preparation & Use
1	<i>Amorphophallus paeoniifolius</i>	Elephant Yam	Araceae	Paste with borax in mustard oil applied orally for haemorrhagic septicaemia.
2	<i>Momordica charantia</i>	Bitter Gourd	Cucurbitaceae	Boiled in milk, paste fed for fever.
3	<i>Aloe barbadensis</i>	Aloe Vera	Asphodelaceae	Gel solution fed to relieve fever & heat stress.

1E. Respiratory Disorders

S. No.	Botanical Name	Common Name	Family	Preparation & Use
1	<i>Vernonia amygdalina</i>	Bitter Leaves	Asteraceae	Fresh leaves fed to relieve cough.
2	<i>Pergularia daemia</i>	Hapur/Hapus	Asclepiadaceae	Leaf paste in water fed to treat pneumonia and respiratory diseases.

1F. General Health and Immunity Enhancers

Sl. No.	Botanical Name	Common Name	Family	Preparation & Use
1	<i>Moringa oleifera</i>	Moringa	Moringaceae	Leaves/paste fed for diarrhoea, fever & immunity.
2	<i>Tinospora cordifolia</i>	Giloy	Menispermaceae	Stem decoction/paste given for anorexia and immunity.
3	<i>Phyllanthus emblica</i>	Amla	Phyllanthaceae	Fruits fed to boost immunity, treat alopecia & tympani.

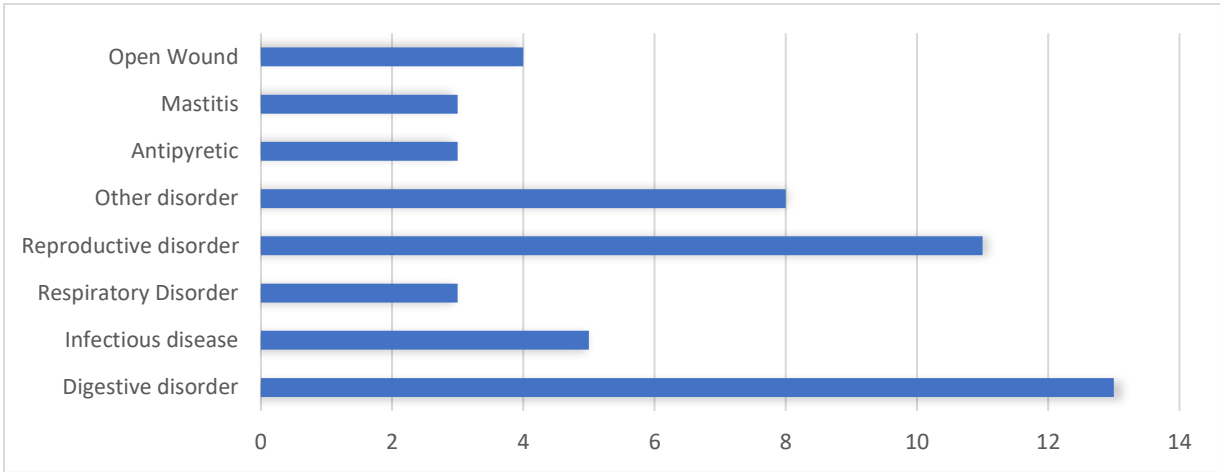


Fig. 1: Ethnoveterinary practices used for curing various ailments.

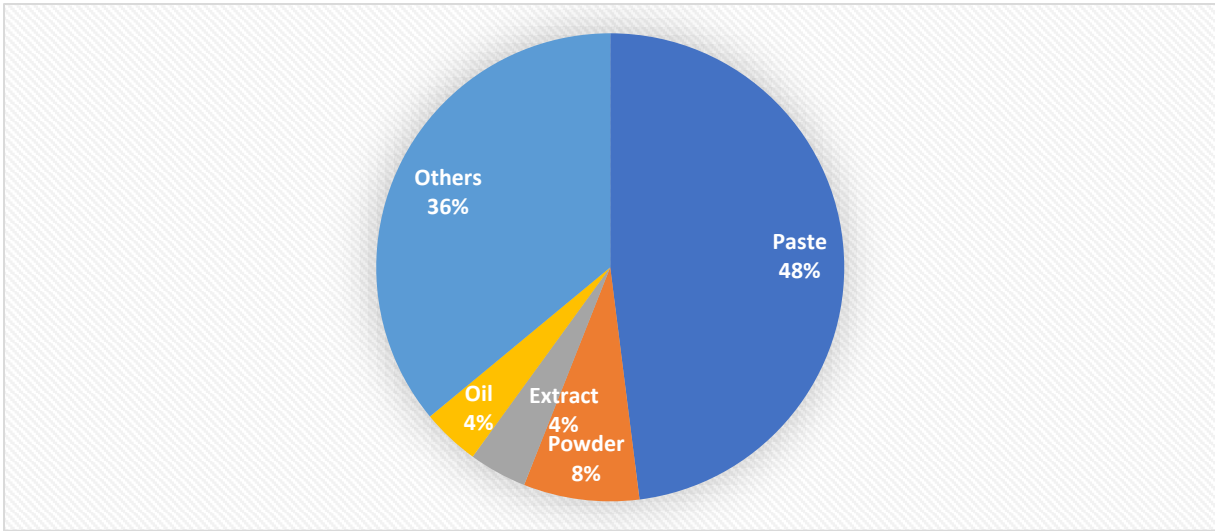


Fig. 2 Mode of application of various ethnoveterinary practices

Plant Parts Utilized

The study identified that, leaves as the most frequently used plant part (19 cases), followed by seeds and stems (8 cases each). Other parts such as roots, bark, fruits, and flowers were comparatively less used. The reliance on leaves is significant as they are easily available throughout the year and can be harvested sustainably without destroying the plant. Moreover, leaves are known to be rich in bioactive compounds including alkaloids, tannins, and flavonoids, which provide antimicrobial, anti-inflammatory, and antioxidant properties (Umair et al., 2024; Oda et al., 2024).

Therapeutic Applications of Key Plant Species

The categorization of ethnomedicinal plants into major ailment groups revealed important trends. Dermatological and external conditions accounted for the largest share (32.00%), reflecting the prevalence of mastitis, skin infections, wounds, and ectoparasite infestations in rural livestock systems. Digestive disorders formed the second-largest category (20.00%), underscoring the high incidence of gastrointestinal problems linked to poor-quality fodder, water contamination, and seasonal feed scarcity. Reproductive disorders (16.00%) were also prominent, highlighting farmers’ concern with fertility, parturition, and postpartum complications that directly affect herd productivity. Infectious and febrile conditions (6.00%), respiratory ailments (4.00%), and general health/immunity-related uses (6.00%) comprised smaller yet significant proportions.

Multi-Plant Combinations and Holistic Healthcare

Several remedies combined multiple plants, reflecting a holistic approach to animal healthcare. For instance, a formulation of *Sesamum indicum* (sesame), *Moringa oleifera* (moringa), and *Cannabis sativa* (hemp) was used for treating diarrhea.

Discussion

The predominance of digestive and reproductive disorders aligns with the realities of rural livestock farming, where inadequate nutrition, poor-quality fodder, and unhygienic conditions often predispose animals to gastrointestinal complications and reproductive failures (Shoaib et al., 2021). Similar findings have been reported from other parts of South Asia, where ethnoveterinary knowledge is primarily oriented toward maintaining digestive efficiency and reproductive success; two cornerstones of livestock productivity (Rehman et al., 2022).

The findings on Preparation and Mode of Application corroborates earlier studies from Italy and Pakistan, which found pastes and decoctions as the preferred forms due to their simplicity and versatility (Rehman et al., 2022). The wide spectrum of preparation techniques documented in the present study demonstrates the adaptability of rural communities in tailoring remedies according to specific ailments and resource availability, reflecting a sophisticated understanding of plant pharmacology at the local level. The selective use of specific plant parts demonstrates community knowledge of plant pharmacodynamics reflecting a conservation-oriented approach embedded in indigenous practices (Rehman et al., 2022).

The categorization of ethnomedicinal plants are consistent with earlier ethnoveterinary studies in India and abroad, which also reported higher reliance on plant-based remedies for digestive and reproductive disorders (Shoaib et al., 2021; Rehman et al., 2022). The results suggest that traditional knowledge systems are strongly oriented toward maintaining productivity-related health parameters in livestock, reflecting both ecological realities and economic priorities of rural households.

The ethnoveterinary knowledge documented in this study (Table.1) encompassed 50 plant species, many of which are well-recognized in both traditional and modern pharmacology. These plants were not used arbitrarily but were carefully selected and applied for specific livestock ailments, reflecting the community's multifaceted understanding of disease pathology and plant bioactivity for the treatment of the Dermatological / External Conditions, Digestive, Reproductive, Infectious / Febrile Conditions, Respiratory and General Health and Immunity Enhancers. Some important of them discussed below;

***Blumea lacera* (Kukraundha):** Juice extracted from its leaves was frequently applied for external wound healing. Its use is strongly supported by experimental studies, which have demonstrated the plant's antiseptic, anti-inflammatory, and tissue-regenerative properties (Chandak et al., 2020). The presence of flavonoids and tannins in *Blumea lacera* explains its efficacy in promoting wound contraction and reducing microbial infection, making it a critical first-aid remedy in rural livestock healthcare.

***Datura stramonium* (Datura):** Seeds and fruits of this plant were administered orally to treat diarrhea. This practice aligns with *Datura's* well-known astringent, antibacterial, and antispasmodic properties (Sayyed & Shah, 2014; Baynesagne et al., 2017). Despite its recognized toxicity in high doses, healers demonstrate precise knowledge in preparing controlled dosages, showcasing indigenous expertise in balancing efficacy with safety. This underscores the importance of dosage regulation in integrating such remedies into veterinary practice.

***Allium cepa* (Onion) and *Piper nigrum* (Black pepper):** A synergistic mixture of onion bulbs and black pepper seeds was administered orally to livestock for the treatment of anorexia. The rationale behind this combination is rooted in the stimulatory effect of pungent phytochemicals (allyl sulfides in onion and piperine in black pepper), which enhance appetite, improve gastric secretions, and aid digestion (Kuralkar & Kuralkar, 2021). This demonstrates how communities effectively harness synergism between plant species to maximize therapeutic outcomes.

***Curcuma longa* (Turmeric) and *Trachyspermum ammi* (Ajwain):** These species were commonly prescribed in cases of mastitis and postpartum disorders. Turmeric is rich in curcumin, a compound with strong anti-inflammatory, antimicrobial, and antioxidant properties (Kumar & Sakhya, 2013). Ajwain, on the other hand, is a well-known carminative and analgesic, reducing postpartum discomfort and supporting uterine recovery (Prakash & Jain, 2017). The combined use highlights the holistic perspective of ethnoveterinary medicine, where remedies address both primary pathology (infection, inflammation) and secondary complications (pain, digestion).

***Ficus religiosa* (Peepal):** Leaves of *F. religiosa* were administered to cattle for facilitating placenta expulsion after parturition. This application resonates with previous studies which describe its oxytocic, anti-inflammatory, and uterotonic properties (Singh et al., 2011; Singh & Yadav, 2016). The use of this plant highlights how traditional practices effectively target reproductive health—an area critical to sustaining livestock productivity and farmer income.

***Tinospora cordifolia* (Giloy):** Widely utilized in Bihar for managing lumpy skin disease and enhancing livestock immunity, *T. cordifolia* is pharmacologically renowned for its immunomodulatory, anti-inflammatory, antipyretic, and hepatoprotective properties (Chaudhary et al., 2024; Gupta et al., 2024). Its role in disease resistance is particularly significant in the context of increasing infectious disease outbreaks and reduced effectiveness of synthetic drugs, marking it as a promising candidate for integration into mainstream veterinary therapeutics.

These cases illustrate that ethnoveterinary knowledge is not merely empirical but evidence-based, often aligning with contemporary pharmacological findings. The careful selection of specific plants for distinct conditions, the formulation of synergistic mixtures, and the emphasis on reproductive, digestive, and infectious health reflect the precision and adaptability of indigenous veterinary practices. Moreover, the overlap between traditional wisdom and scientific validation reinforces the argument for systematic pharmacological research to unlock the full potential of these ethnomedicinal species in sustainable livestock healthcare.

The formulation for treating diarrhea, *Sesamum indicum* (sesame), *Moringa oleifera* (moringa), and *Cannabis sativa* (hemp); though direct pharmacological evidence for this exact combination is scarce, studies confirm the antidiarrheal effects of *Moringa* (Woldeyohannes et al., 2022) and the anti-inflammatory and antioxidant properties of hemp-derived compounds when combined with moringin from *Moringa* (Rajan et al., 2016). Sesame has long been used in traditional medicine for digestive support (Mishra et al., 2019), and recent studies indicate its supportive role in metabolic balance (Udebunu et al., 2023).

Such poly-herbal formulations suggest that communities intuitively combine plants for synergistic effects, targeting multiple symptoms or enhancing overall resilience. This aligns with the Ayurvedic principle of *yoga* (synergy), where combinations are believed to amplify efficacy and minimize side effects.

Broader Implications and Way Forward

The findings underscore the sustainability and relevance of EVPs in contemporary livestock farming. With rising concerns about antimicrobial resistance, escalating costs of pharmaceuticals, and biodiversity loss, these practices offer eco-friendly, affordable, and culturally embedded alternatives to conventional veterinary care (WHO, 2019; Tiwari et al., 2020). However, challenges remain. Despite widespread use, scientific validation is limited. Without proper pharmacological studies, clinical trials, and standardization, these remedies cannot be fully integrated into formal veterinary healthcare systems (Singh & Yadav, 2016). Therefore, documenting and validating these practices is essential not only for preserving indigenous knowledge but also for harnessing their potential in developing novel veterinary drugs and integrative health solutions.

Conclusion

Ethnoveterinary practices in Bihar represent a rich and adaptive traditional knowledge system that integrates local resources, culture, ecology, and animal health management. These practices provide accessible, affordable, and potentially sustainable healthcare options for livestock, particularly in resource-constrained rural communities. Their systematic documentation, scientific validation, and appropriate integration with modern veterinary medicine can help preserve indigenous knowledge, reduce treatment costs and dependence on synthetic drugs, and promote responsible antimicrobial use. Such integration can contribute to sustainable livestock production, animal welfare, rural livelihood improvement, biodiversity conservation, and a broader One Health approach.

Acknowledgement

The authors sincerely acknowledge the financial support provided by the Network Project on Animal Genetic Resources (ICAR-NBAGR, Karnal) for conducting this research. We extend our heartfelt gratitude to the local healers, farmers, and livestock keepers for sharing their invaluable knowledge and information. Additionally, we express our deep appreciation to the Director of Research, BASU, Patna, for his essential guidance in carrying out this study.

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