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Ethnoveterinary Practice May be an Alternative to Antibiotics in Dairy Cattle

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Abstract— *Ethnoveterinary practices in India have their origins in ancient times, characterized by the transmission of indigenous knowledge, beliefs, and skills related to the diagnosis, treatment, and management of diseases in both animals and humans. These practices, preserved and refined over generations, have evolved into cost-effective alternatives to conventional medicine, particularly benefiting small-scale farmers. In contemporary veterinary medicine, the integration of ethnoveterinary practices presents a viable strategy for reducing the overreliance on antibiotics. These traditional methods not only support growth and productivity in livestock but also offer effective solutions for the prevention and treatment of common animal diseases. The adoption of such practices holds significant potential in addressing the escalating threat of multidrug-resistant pathogens. Many such plant based remedies are there in veterinary practice that can be used as a preliminary alternative to antibiotic use in primary health care of the animals. However, to fully harness the benefits of ethnoveterinary medicine, further research is needed to validate these practices, including studies on dosage, duration, pharmacokinetics, pharmacodynamics, and toxicity patterns including residual effects as they also do contain potent active principles.*

Keywords— ***Ethnoveterinary Practice, Antibiotic alternative, Pharmacology***

I. INTRODUCTION

Ethnoveterinary practices, which date back to the domestication of various livestock species, represent an ancient approach to animal healthcare. These practices involve the use of indigenous knowledge, beliefs, and skills related to the care and management of humans, animals, and birds (Mc Corkle, 1986). Known as ethnoveterinary practices (EVPs), this branch of science is gaining increasing attention in the field of ethnobotany, particularly in Western countries (Lans et al., 2006). India, with its vast repository of ethnoveterinary knowledge, is emerging as a potential 'EVP hub,' thanks to decades of practical experience. Traditionally, these practices are grounded in the use of plant-based formulations and other locally sourced, affordable ingredients. Livestock owners and individuals with deep-rooted knowledge of veterinary medicine traditionally classify, diagnose, prevent, and treat common animal ailments using these methods. The use of such traditional medicines for animal healthcare not only significantly reduces costs but also ensures accessibility for the average farmer.

II. ANTIMICROBIAL RESIDUE AND AMR

The introduction of exotic cattle strains has led to increased milk production but has also made these animals more susceptible to diseases. The misuse of antibiotics in dairy animals has resulted in elevated antibiotic residues in animal products like milk and meat. Antibiotic resistance (AMR) is a global concern, posing serious risks to both human and animal health, with predictions of 10 million deaths annually by 2050. In India's livestock sector, there is an urgent need to shift from expensive antibiotics and chemical veterinary drugs to more cost-effective herbal remedies derived from medicinal plants. An intervention

impact study, currently under publication, shows a significant reduction in the incidence of mastitis, enteritis, repeat breeding, and cowpox from 2016 to 2019 when herbal alternatives were utilized. Additionally, a microbiome analysis of milk from cows with mastitis, conducted before and after treatment with EVP, revealed a marked decrease in the abundance of mastitis-causing bacteria, including Streptococcus, Staphylococcus, the Enterobacteriaceae family, and Pseudomonas, with levels dropping to a minimum after just six days of treatment (Nair and Punniamurthy, 2023).

In order to lessen the reliance on antibiotics and other chemical medications in veterinary healthcare, herbal ethno-veterinary practices (EVP) are significant alternatives. EVP would prevent the issue of antimicrobial resistance (AMR) and aid with the decrease of antibiotic and other chemical drug residues in animal products. EVP will result in more livestock wellbeing and safer, more affordable dairy products. In the long run, this strategy will improve both human and environmental wellbeing. Farmers have discovered that recently made EVP formulations are quite helpful in controlling and preventing specific clinical problems in livestock. Three years of using herbal formulations for a variety of clinical diseases in cattle in a chosen area has shown a general decrease in the incidence of cowpox (100%), repeat breeding (96%), enteritis (63.6%), and mastitis (83.3%). Furthermore, it has been noted that in approximately 88% of milk samples, there was no discernible antibiotic residue. Farmers were able to save 75% of their livestock's medical costs on average because to these inexpensive herbal mixtures (Nair and Punniamurthy, 2023).

Mastitis and ethnoveterinary treatment

Ethno-veterinary medicine (EVM) is the application of humankind’s expertise, abilities, practices, habits, and credence in managing and safekeeping the well-being of their animals . These hands-on skills are shared or transferred from age to age only through the oral medium . Both the scientific and consumer communities are increasingly turning to herbal plants as health promoters. In the interests of the foremost availability of these products and the cheap manufacturing costs around these items, studies using local plants must of necessity encompass multiple geographical locations. Kalayou et al. (2012) investigated the antibacterial potency of several plant species against mastitis, with *Croton aurea*, Croton macrostachyus, *Achyranthes aspera, Nicotiana tabacum* and *Vernonia* species producing the most promising effects of all tested plants. Findings by Serunkuma et al. (2017) established the efficacy of the acetone extract of the *Acacia nilotica* bark and the *Tetradenia riparia* flower against bacterial species cultured from mastitis samples from a farm. Across the board, the development of *S. agalactiae, S. uberis, E. coli* and *S. aureus* was suppressed by a methanol extract derived from *Spathodea campanulata*. Globally, the use of diverse plants from distinct geographical terrains to treat livestock infections remains common. In-vitro assays into medicinal plants reveal their potency as antibacterial, anti-inflammatory or immune-modulatory agents.

Mastitis is a disease in which the highest quantity of antimicrobials are used for the therapy as well as the prevention. Application of Ethno-Veterinary Medicine in the Treatment and Management of Mastitis Ethno-veterinary medicine is a local animal healthcare system that incorporates traditional beliefs, knowledge, skills, methods, and practices. It includes the traditional treatment of veterinary illnesses, as active substances to be extracted, the delivery route, and the medicinal purpose (prophylaxis or therapeutics), the method used to make ethno-veterinary medications differs. Infusions, decoctions, powders, drips, fumes, pastes, and ointments are made from medical plants, animal products, minerals, and other inorganic ingredients accessed by livestock owners and ranchers. These might be treated topically with drenches, or intra-nasally with smoke, vaccines, or suppositories, vapors, or massages (Ajose et al., 2022).

Abbasi et al. (2013) reported that paste made from the fruit juice of *Citrus limon* and sugar fed to animals and applied topically to the mammary glands for 10-15 days is used to treat mastitis in buffalo, cattle and goats. Also, the application of a paste of 200 g of fresh crushed roots of *Withania somnifera* to the udder of a cow and goat respectively for up to a week successfully treats the diseased condition. It is also noteworthy to state that the preparation and application of the smoke of the leaves and branches of *Peganum harmala* over a period of about 5 days successfully treats mastitis in cattle and horses. The *antiinflammatory* effects of the topical application of the extract of fresh leaves of *Rumex nepalensis* to the affected part for about 5 days has also been reported. A poultice of young twigs of Calotropis procera applied to a swollen udder also relieves pain and inflammation.

Ethno-veterinary medicinal plants used in the dairy and livestock farming (Ajose et al., 2022)					
Scientific name	**Family**	**Life form**	**Plant part used**	**Animal**	**Use/disease**
Erysimum melicentae Dunn.	*Brassicaceae*	Herb	Whole plant	Cattle and sheep	For general health improvement
Becium obovatum (E. Mey. Ex Benth. In E. Mey.) N.E. Br.	*Lamiaceae*	Herb	Root	Livestock	Mastitis, Black leg, listeriosis/encircling disease, diarrhea
Malva parviflora	*Malvaceae*	Herb	Whole Plant	Cattle	Mastitis
Brucea antidysenterica	*Simaroubaceae*	Tree	Leaf	Cattle	Mastitis
Acorus calamus L.	*Acoraceae*	Herb	Rhizome	Cows, Sheeps, Goats, Donkeys, Camels, Buffaloes	Mastitis, Anaplasmosis, constipation, heal wounds, dysentery, body tonic, gastric problems, bloating, indigestion, urinary disorder
Prosopis juliflora (Sw.) DC.	*Mimosaceae*	Shrub	Leaf	Cattle	Infections
Triticum sp.	*Poaceae*	Herb	Aerial parts, Bran	Livestock	Mastitis, breast lumps, difficulty of birth, retained placenta, increasing egg production
Arachis hypogea L.	*Fabaceae*	Shrub	Seed and seed oil	Goat and cattle	Increased milk production
Peganum harmala L.	*Zygophyllaceae*	Herb	Leaf, branches	Buffalo, Cattle, Dog	Mastitis
Citrus limon (L.) Osbeck	*Rutaceae*	Tree	Fruit	Buffalo, Cattle, Goat	Mastitis
Withania somnifera (L.) Dunal	*Solanaceae*	Shrub	Root	Buffalo, Cattle, Goat	Mastitis

Natural products and/or organic by-product forms continue to play a pivotal role in the medication upshot process. As a result, biological diversity offers an endless supply of new chemical entities (NCEs) with their potential as therapeutic leads. These NCEs are derived productsgenerated by plants to shield them from herbivores and pathogens, or to attract pollinators. An herbal mixture of *Aloe vera* (L.) Burm. -F., *Curcuma longa* L. and calcium hydroxide, as documented by a traditional healer, was reported to be efficient against mastitis causing pathogens. Apart from this, many more plants are being used for the treatment and control of bacterial mastitis in cows and thus reducing the incidence of mastitis.

Ethno-veterinary medicinal products, preparation and administration for the treatment and control of mastitis		
Plant	**Plant part**	**Administration/dosage for cows**
Allium sativum L.	Rhizome	250 g, grinded with butter and administered orally for 7 days
Allium cepa L.	Bulb	Heated in oil, given as food supplement once per day during 2 or 3 days or until the animal gets better (topical application and vaginal washes)
Asphodelus tenuifolius Cav.	Aerial part	Heated with barley peels (topical application)
Amomum subulatum Roxb.	Fruit	25 g, given orally for 3 days.
Brassica compestres + *Curcuma longa*	Seeds + root	250 g seeds are grinded with 50 g root and administered orally for 5 days
Brucea antidysenterica JF. Mill	Seed	Add 1 L of water to the ground fresh seed given orally once per day for 3 days
Peganum harmala + *Triticum sativum*	Fruit + stem crushing (hay)	50 g + 2 Kg, fumigation of harmal by putting it on fired hay under the affected udder for 4 days
Capsicum annuum	Fruit/whole plant	50 g, given orally for 8 days
Sesamum indicum	Seed oil	250 ml, mixed oil in 1.5 L of milk whey, and given orally for 7 days
Citrus limon	Extract	With raw sugar given orally for 5 days
Osyris quadripartita Decn.	Root	Pound the fresh root and mix with water, filter and administered orally for 6-7 days, daily
Gossypium hirsutum L.	Flowers	250 g, boiled in 1 L water to 250 ml, then drenched for 3 days
Galium aparine L.	Vine	500 g, given as decoction drench for 3 days
Chenopodium ambrosioides L.	Leaf	After grinding the fresh leaf, mix with water to prepare (liquid) 1 L then it is given orally once
Solanum spp.	Leaf	The fresh leaf and root are chewed by the local healer and spit to the mouth of the animal for 2 days
Artemisia herba-alba Asso	Aerial part	Heated with barley peels and/or aggaya (topical application)
Ricinus communis L.	Leaf	Pound about 50 g of fresh leaf and mix with 1 L of water then administered orally 1 L/day (every morning) for 2 days
Cynomorium coccineum L.	Whole plant	Wash with decoction water
Hordeum vulgare L.	Seed	Roasted seeds mixed with water
Ziziphus spina-christi	Leaf	The leaves are ground and applied on the affected teat

		quarter
Achyranthes aspera + *Commicarpus podunculosus*	Root + leaf	The fresh root of an A*chyranthes aspera* is chopped and bounded together with a leaf of *Commicarpus podunculosus*. This will be mixed with water and given orally

Other bacterial diseases where plants can be used alternatively.

Many plants or the parts are also used in different types of wounds infected by different type of bacteria with good success (Verma et al., 2023).

1. *Corymbia citriodora* (Lemon-scented gum): The essential oil extracted from the leaves and fruits of this plant, when administered at doses of 0.125, 0.25, and 0.5 mg/kg, demonstrated 100% efficacy in sheep. The treatment induced the formation of vacuoles, muscular disorganization, and alterations in the mitochondrial profile.
2. *Ocimum tenuiflorum (Tulsi):*The aqueous ethanol extract of *Ocimum tenuiflorum* exhibited antibacterial activity at concentrations ranging from 0.5 to 1000 µg/mL against Gram-positive bacteria, including *Staphylococcus aureus*, CNS, and *Streptococcus agalactiae*, but was ineffective against Gram-negative bacteria.
3. *Argemone mexicana Linn*. (Kateli ka phool): Aqueous extracts prepared from 100 g of leaves and 100 g of fruits of *Argemone mexicana* are applied topically to treat foot infections.
4. *Bambusa arundinacea* (Bamboo): The rhizome and fresh leaves of bamboo, used in equal amounts, are applied for therapeutic purposes.

Ethnoveterinary practices present a promising alternative to the use of antibiotics, but more rigorous studies, including those with proper control groups and double-blind methodologies, are necessary to identify potential candidates for new drug discovery. The author contends that homeopathic products lack proven efficacy against bacterial diseases in livestock when compared to placebos, and they are no more effective than placebos. Therefore, it is advisable not to recommend them for treating cattle ailments. There is significant potential in screening plants for active principles that could serve as alternatives to synthetic antibiotics or antimicrobial drugs. However, as of now, these alternatives cannot replace antibiotics used in treating many cattle diseases, and further research is required to develop novel therapeutic molecules.

III. CONCLUSION

Protection of animal health is necessary for human health. Infection reduction requires rapid diagnosis, epidemiological projections, safer and better vaccines, and hygiene. India lacks cold storage and transport infrastructure to deliver vaccines to rural areas. Advanced diagnostic tests speed up disease diagnosis and differentiation. Better farmer awareness and door-to-door veterinarian services might control dairy animal infections. Budget constraints, low vaccination rates, and poor infrastructure restrict herd immunity in emerging nations like India. This compilation discusses Indian ethnoveterinary medicinal plant dairy cow illness prevention and treatment without any antimicrobial resistance.

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