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Bacterial infections in Tamil Nadu's free-range Indigenous cattle: Insight into AYUSH treatments

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India takes pride in home a large livestock population, with Tamil Nadu alone housing approximately 9.5 million free-range cattle. These cattle are vital for rural livelihoods as they provide natural fertilizer, meat, milk, and even play a role in traditional Tamil bull fighting. However, due to climate change and polluted grazing lands, these animals are at risk of diseases like brucella, anthrax, pneumonia etc. Our study focused on 736, "**Pullikulam**", indigenous cattle breed known for their disease resistance. We found that during winter (June-February), 2.3% of the animals contracted tuberculosis and pneumonia by grazing in shrub jungle. In summer (March-May), 1.08% suffered from diseases caused by organisms such as *Clostridium*, *E. coli*, and Mastitis during grazing in post-harvest wet lands, diagnosed through immunological methods. These herd illnesses not only impact animal health but also cause financial hardship for marginal farmers, with an average daily revenue loss of $125 in our study group. Limited access to veterinary hospitals due to transportation and treatment costs is a major challenge. Indian system of medicine AYUSH (Ayurveda, Yoga, Unani, Siddha and Homeopathy) offers a promising solution. India's rich botanical diversity provides a natural wealth of resources for animal healthcare. For centuries, farmers have relied upon plant-based AYUSH remedies to treat animal diseases. In our study, five different Siddha formulations are administered orally with bananas to symptomatic animals for 21 days which subsequently relieved of infections. These treatments promise to be safe and effective. Additionally, traditional knowledge empowers farmers to develop new herbal formulations for animal health management. This research paves the way for developing eco-friendly and cost-effective veterinary medicines based on AYUSH principles. It highlights the vulnerability of free-range cattle to diseases and the potential of AYUSH treatments as a solution. Furthermore, it underscores the valuable role of indigenous knowledge in preserving traditional veterinary practices

Introduction

India boasts a substantial livestock population, with Tamil Nadu alone has about approximately 9.5 million free-range cattle. These animals are integral to rural livelihoods, providing natural fertilizer, meat, milk, and playing a significant role in traditional Tamil bullfighting. Despite the importance of livestock, many small and marginal farmers face challenges in affording modern veterinary care due to limited income and access to resources. As a result, they often turn to traditional Siddha medicine-AYUSH (Ayurveda, Yoga, Unani, Siddha and Homeopathy) a system of healing with a history spanning over 5,000 years (Shankar, 2016; Ponnulekshmi & Rabinarayan, 2024)

This study develops into the traditional Siddha medicine (AYUSH) and ethno-botanical practices employed to manage bacterial infections in free-range cattle. The primary objective is to document this valuable indigenous knowledge, particularly concerning the seasonal nature of these bacterial infections.

Methods

Area & Period of study: Tamil Nadu State is a tropical region situated at the south eastern extremity of the Indian peninsula. It lies between 8.5° and 13.35° North latitude and 76.15° and 80.20° East longitude. (fig.1) The study was conducted in the Madurai district of Tamil Nadu state, India during March 2023 to July 2023 (Summer season) and October 2023 to February 2024 (Winter season).

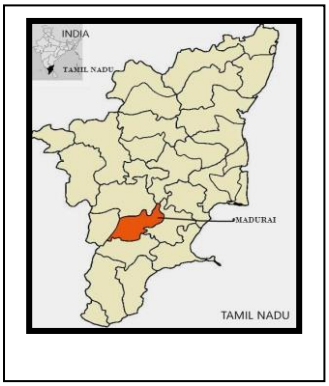

Fig1: Tamil Nadu State showing Madurai District

Study Analysis: A seasonal analysis was conducted for five diseases namely Mycobacterial infection, Pneumonia, Clostridial infection, Escherichia infection, and Mastitis, specifically targeting the indigenous disease-resistant Pullikulam cattle breed. Symptomatic animals were diagnosed by analyzing blood and milk samples using commercially available rapid immuno-diagnostic kits based on antigen-antibody agglutination assay for each type of infection.

Siddha (AYUSH) Formulations: Five different Siddha formulations (AYUSH) were used to treat bacterial infections. These formulations were administered orally to animals exhibiting symptoms such as fever, shivering, diarrhea, swollen udder, cough, mucus and phlegm secretion, and joint edema. (Table.1 and 2)

Monitoring and Evaluation: Animal samples were collected periodically (0, 7, 14, and 21 days) before and during treatment. Rapid immuno-diagnostic kits based on antigen-antibody agglutination assay for each type of infection were performed using the slide method and staining to assess the disease and treatment's efficacy. The provided formulations are commonly used by marginal farmers in the region from their traditional knowledge and found to be effective for reducing the symptoms. Hence our study focused for scientific validation through immunodiagnostic Tests.

Table-1: Name of the plants used in Siddha - AYUSH formulation

Botanical Name	Tamil Name	Common Name	Toxicity as per Siddha
Pergularia daemia (Forssk.) Chiov.	Uthamani	Trellis vine	Safe
Aegle marmelos (L.) Correa	Vilvam	Bael, wood apple	Safe
Delonix elata (L.) Gamble	Vathanarayanan	Peacock flower	Safe
Azadirachta indica A. Juss.	Vembu	Neem	Non toxic
Capparis zeylanica L.	Athandai	Ceylon caper	Safe
Leucas aspera (Willd.) Link.	Thumbai	Thumbai	Safe
Zingiber officinale Roscoe	Inji, sukku	Ginger	Safe
Piper nigrum L.	Milagu	Black pepper	Safe
Piper longum L.	Thippili	Long pepper	Safe
Acorus calamus L.	Vasambu	Sweet flag	Some toxicity in fresh rhizome
Ferula foetida (Bunge) Regel	Perungayam	Asafoetida	Safe
Gossypium herbaceum L.	Paruthi	Levant cotton	Safe
Taxus baccata L.	Thalisapatri	Common yew	Safe
Allium cepa L.	Venkayam	Onion	Safe

Table-2: Formulation and Administration of drugs for Bacterial infection

S.No.	Bacterial Infection	Formulation	Method of Administration
1.	Escherichia Infection	juice of Pergularia daemia	Orally given with buttermilk and salt
2.	Mastitis	powder of Aegle marmelos, Delonix elata Azadirachta indica, Capparis zeylanica, and Leucas aspera leaves	Orally given with luke warm water or with banana
3.	Mycobacterial infection	mixture of Zingiber officinale, Piper nigrum, Acorus calamus, Piper longum, Ferula foetida, Azadirachta indica leaf juice, and Gossypium herbaceum fruit juice	Orally given as juice or with banana
4.	Pneumonia	mixture of Piper nigrum, Piper longum, and Taxus baccata	Given with ghee or with banana
5.	Clostridial infection	macerate of Allium cepa, Acorus calamus	Given with castor oil vinegar and salt or with banana

Results

Upon survey through marginal farmers, we found that during the monsoon and winter seasons i.e., October to February, cattle's (2.3%) were prone to tuberculosis and pneumonia while grazing in shrub jungles. As well during the period of summer from March to July the cattle's (1.08%) suffered from diseases such as *Clostridium*, *E. coli*,

and mastitis while grazing in post-harvest lands. These diseases were diagnosed through immunological methods and staining. After one week of oral administration of the formulation, there was a significant reduction in symptoms, and the specific pathogen antigen level decreased in agglutination reactions in the immunodiagnostic tests. Mycobacterium found in sputum even after 21 days treatment.

A survey of marginal farmers revealed that during the monsoon and winter seasons (October to February), 2.3% of their cattle were susceptible to tuberculosis and pneumonia while grazing in shrub jungles. During the summer months (March to July), 1.08% of cattle suffered from diseases such as *Clostridium sp, E. coli*, and mastitis while grazing on post-harvest lands. The samples were collected in the morning hours between 6.00am to 7.00am The tests were carried out immediately when there is appearance of clinical signs of the cattle inspected in all the months. These diseases were diagnosed using immunological methods. Following one week of oral administration of the herbal formulation, a significant reduction in symptoms was observed. The specific pathogen antigen levels decreased in agglutination reactions during immunodiagnostic tests. However, *Mycobacterium sp* was still detected in sputum samples after 21 days of treatment. These findings have been tabulated. (Table.3).

Marginal farmers in Madurai district practice traditional Siddha veterinary treatments, and our results demonstrate the efficacy of herbal formulations in reducing the burden of cattle diseases. These Siddha herbal treatments significantly reduced the antigen load in both the blood and milk of the cattle. Based on our study, farmers concluded that these Siddha herbal formulations can be administered prophylactically to all cattle throughout the year to prevent the aforementioned diseases. The study results emphasize the effectiveness of Siddha herbal treatment and offer hope for marginal farmers.

These findings could serve as foundational research for pharmacological studies of Siddha formulations, potentially leading to alternatives to allopathic medications in livestock management. This study focuses on the use of traditional remedies for prompt animal care, as well as the associated social aspects.

Table-3: Slide Agglutination Test Results:

S. No	Types of Infection	Sample from infected animals	Number of Animals	Test Performed	Presence of Bacterial Antigens/ organisms/cattle antibodies			
					0 day	7th day	14th day	21th day
1	Escherichia *Infection*	Serum	17	*E coli* slide agglutination test kits	Positive-	Negative	Negative	Negative
2	Mastitis infection	Milk	17	Slide agglutination test kit/ staining	Positive-	Positive	Positive	Negative
3	Mycobacterium Infection	Milk & Sputum	8	Rapid slide agglutination kit /Staining	Positive-	Positive	Positive	Positive
4	Pneumonia infection	Serum	8	Slide agglutination kit	Positive-	Negative	Negative	Negative
5	Clostridium infection	Serum & Stool	17	Toxin agglutination kit	Positive-	Positive	Positive	Negative

Discussion

The information provided discusses about complete disease recovery for all the bacterial infections listed above after 21 days with both symptoms and antibody titers, except Mycobacterial infection which persist even after treatment. This suggests that the traditional formulation reduced symptoms in a readily observable way. Improved

productivity was confirmed by the local farmers using simple inexpensive measurements such as i.e., body weight, fat cover, milk and fighting ability.

Modern veterinary and chemical interventions have improved livestock health and productivity, but they raise concerns about environmental impact, consumer health, and the preservation of indigenous breeds. In contrast, traditional methods, relying on natural remedies, apart from curing the diseases can enrich soil, maintain genetic diversity, and reduce the need for chemicals. Livestock raised traditionally may produce healthier products and support sustainable livelihoods, benefiting small farmers and local economies. However, traditional methods might not prevent major disease outbreaks or match the productivity of modern farming. The solution is a balanced approach that integrates both traditional and modern practices to maximize benefits and sustainability.

Conclusion

Traditional livestock health management in India presents a promising path for sustainable and ethical farming. By combining traditional knowledge with modern scientific methods, it's possible to create holistic approaches that benefit both farmers and consumers. Future research should focus on documenting and assessing the effectiveness of traditional practices, as well as exploring ways to integrate them into contemporary livestock management systems for improved sustainability.

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