Review Article

Exploring the Kazhichal Marundhu: A Siddha-Based Herbal Anti-Diarrheal Formulation for Livestock – A Review on its Therapeutic Potential and Pharmacological Insights

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Received: 06-04-2025; **Revised:** 23-06-2025; **Accepted:** 10-07-2025; **Published online:** 15-07-2025.

ABSTRACT

Diarrhea is a common gastrointestinal disorder in livestock, leading to significant economic losses due to reduced productivity, dehydration, and increased veterinary costs. The complex nature of cattle diarrhea is attributed to both pathogen and host variables. The most frequent causes of infectious diarrhea in calves are rotavirus, corona virus, *Cryptosporidium parvum*, entero toxigenic Escherichia coli, or a mix of these pathogens. The presence of several pathogens frequently results in increased mortality and morbidity. Conventional treatments often rely on synthetic antimicrobials and anti-diarrheal drugs, which may possess risks such as antibiotic resistance and adverse side effects. As a result, there is a growing interest in exploring natural, plant-based alternatives that offer safe and effective solutions for managing diarrhea in animals. This review article explores the potential of a Siddha-based herbal formulation "Kazhichal Marundhu" in veterinary practice, focusing on its pharmacological properties, mechanism of action, and benefits over conventional treatments. By integrating traditional knowledge with modern veterinary science, herbal Siddha formulations could provide a sustainable and effective approach to managing diarrhea in livestock.

Keywords: Cattle diarrhea, herbal, veterinary medicine, infectious disease, Siddha.

INTRODUCTION

Livestock is an essential component of agriculture and it contributes significantly to the general public's nutritional security[1]. India has the largest animal husbandry industry globally with 512.06 million livestock heads[2]. Diarrhea in cattle is frequently observed condition and it continues to be a significant source of productivity loss and financial loss for cattle-producers nationwide[3]. There are both infectious and non-infectious causes of calf diarrhea. Numerous enteric pathogens, including bacteria, viruses, and protozoa, contribute to the development of this illness.

Ten different enteric pathogens are recognized as either major enteric pathogens known to cause calf diarrhea (*i.e.*, bovine rotavirus (BRV), bovine coronavirus (BCoV), bovine viral diarrhea virus (BVDV), *Salmonella enterica*, *Escherichia coli*, *Clostridium perfringens*, and *Cryptosporidium parvum*) along with newly emerging enteric pathogens such as bovine torovirus (BToV) and calici viruses (bovine norovirus [BNoV] and Nebovirus). While a single primary pathogen may be the cause in certain instances[4]. Co-infection is commonly seen in calves that have diarrhea. The geographic location of farms, farm management techniques, and herd size can all affect the presence of each pathogen and disease incidence[5]. In cases of diarrhea, electrolyte loss and dehydration can happen quickly. Vaccination, mineral supplementation, rehydration fluids, anti-inflammatory drugs, ration control, and the prudent use of antibiotics or anthelmintics are some possible treatment options, depending on the cause of the diarrhea[6].While conventional treatments, they often come with drawbacks, including drug resistance, high costs, and potential adverse effects on animal health and productivity. It was noted during the first research of penicillin[7,8]. The emergence of antibiotic-resistant strains poses a significant risk, as they can spread from animals to the environment and humans through direct contact or indirect transmission via animal-derived food[10]. Nowadays it is a major issue for veterinarian also[11]. Hence, there is an increasing demand for natural, plant-based alternatives that provide safe, effective and sustainable solutions for managing diarrhea in veterinary practice.

Siddha medicine, one of the most ancient traditional medical systems, encompasses a vast array of herbal formulations that have been utilized for centuries to treat various ailments, including digestive issues. Based on the principles of balancing the body's humors such as Vatham, Pitham, and Kabam, Siddha remedies aim to restore gut health by addressing the root causes of gastrointestinal imbalances[12]. The Siddha system of medicine is not limited to human healthcare; it also encompasses treatments for livestock. However, the practice of using herbal remedies for veterinary care has been steadily declining in modern times. "Maatu Vagadam" is an 18th-century Siddha manuscript that provides detailed insights into cattle care, including their characteristics, classifications, common diseases, and traditional treatment methods[13]. This valuable text has been preserved as a palm leaf manuscript at Tamil University, Thanjavur. Among the various remedies documented, it specifically mentions Kazhichal Marundhu**,** a herbal anti-diarrheal formulation for cattle. This study aims to investigate the efficacy of the ingredients used in

Kazhichal Marundhu**,** evaluating their potential benefits in managing diarrhea in livestock.

REVIEW OF KAZHICHAL MARUNDHU:

The ingredients of Kazhichal marundhu, taste of the drug, parts used, actions, pharmacognostic aspect and chemical constituents are mentioned below in table 1.

Method of preparation:

All the drugs mentioned above should be powdered separately, mixed all together and get the fine powder after sieved. Final product should be stored it in a separate dry airtight container.

Dose & Adjuvant: Butter or pepper decoction

Indication: Diarrhea of the cattle

PHARMACOLOGICAL ASPECT:

JADHIKKAI and JADHI PATHIRI (*Myristica fragrans*)

The methanolic extract of *Myristica fragrans* exhibited antibacterial properties and demonstrated strong inhibitory effects against *Streptococcus mutans*, an oral pathogen responsible for dental caries[31]. Additionally, dihydroguaiaretic acid derived from mace displayed activity against *Helicobacter pylori*[32]. The petroleum ether extract exhibited effects comparable to those of non-steroidal anti-inflammatory drugs[33]. Moreover, mace lignan isolated from *M. fragrans* showed a hepatoprotective effect against cisplatin-induced liver toxicity in mice[34]. The methanolic extracts of nutmeg seeds also demonstrated significant antioxidant activity, as assessed by the DPPH and FRAP methods, which can be attributed to its high levels of tannins, flavonoids, and terpenoids[35].

Table 1: Ingredients of kazhichal marundhu:

S. No	Tamil name	Botanical name	Quantity
1.	Jadhikkai	*Myristica fragrans (*Houtt)	1/4 palam (8.75 grams)
2.	Jadhipathiri	*Myristica fragrans (*Houtt)	1/4 palam (8.75 grams)
3.	Kirambu	*Syzygium aromaticum* Linn	1/4 palam (8.75 grams)
4.	Masikkai	*Quercus infectoria* Olivier	1/4 palam(8.75 grams)
5.	Lavanga pattai	*Cinnamom verum* J. Presl	1/2 palam (17.5 grams)
6.	Seeragam	*Cuminum cyminum* Linn	1/2 palam (17.5 grams)
7.	Milagu	*Piper nigrum* Linn	1/4 palam (8.75 grams)
8.	Vetrilai	*Piper betle* Linn	1 palam (35 grams)[13]

Table 2: Parts used, taste and action of the ingredient

S. No	Tamil Name	Parts used	Taste	Actions
1.	Jadhikkai	Seed	Astringent, Pungent	Stimulant, carminative, narcotic, aromatic, aphrodisiac, tonic.
2.	Jadhipathiri	Outer shell of seed	Astringent, Pungent	Aphrodisiac, Stimulant, carminative, hypnotic.
3.	Kirambu	Dried flower bud	Pungent	Anti spasmodic, carminative, stomachic
4.	Masikkai	Dried gall	Astringent	Astringent, styptic, tonic
5.	Lavanga pattai	Bark	Pungent with sweet	Stimulant, carminative, aprodisiac
6.	Seeragam	Seeds	Pungent with sweet	Stimulant, carminative, stomachic, Astringent
7.	Milagu	Seeds	Bitter, pungent	Stimulant, rubefacient, carminative, Antivata, resolvent, antiperiodic.
8.	Vetrilai	Leaves	Pungent	Stimulant, carminative, aphrodisiac, astringent, antiseptic, febrifuge, stomachic, galactagogue, sialogogue[14].

Table 3: Pharmacognostic aspect and chemical constituents

Plant name	Family	Botanical description	Chemical constituents
Jadhikkai & Jadhipathiri	Myristicaceae	M. fragrans is a spreading, fragrant evergreen tree that typically reaches a height of 5 to 13 meters, with occasional growth to 20 meters. The nutmeg seeds are oval in shape, solid, meaty, white, and have reddish-brown veins running through them. They are around 2 to 3 cm long. Aril (mace) is brilliant scarlet while new, but it becomes stickier and brittle as it dries, turning yellowish-brown[15].	Myristicin, elemicin, safrole, terpenes, alpha-pinene, beta-pinene, myristic acid, and trimyristin[16,17]
Kirambu	Myrtaceae	Clove trees can reach a height of 8 to 12 meters (26 to 39 feet) when mature. In cultivated environments, they are often pruned to maintain a smaller size for easier harvesting. The dried buds of *Syzygium aromaticum* are small, nail-like in shape, and reddish-brown[18].	Sesquiterpenes, monoterpenes, eugenyl acetate, eugenol, carvacrol and β-caryophyllene[19]
Masikkai	Fagaceae	Quercus is globose with horny appearances on external surface (1.4–2.3 cm in length and 1–1.5 cm in diameter), with greyish-brown to brownish-black in colour externally and dark brown buff colored. Surface is smooth with numerous horny protuberances giving rough touch, and with unpleasant odour[20].	Phenolic compounds, flavonoid, Quercetin, gallic acid[21].
Lavanga pattai	Lauraceae	Cinnamon is a small, evergreen tree that grows up to 10–15 meters in height. The inner bark is stripped, dried, and curled into rolls (quills), which is the primary spice product. It is highly aromatic, sweet, and warm in flavor[22].	Cinnamaldehyde, eugenol, caryophyllene, cinnamyl acetate and cinnamic acid[23].
Seeragam	Apiaceae	Cumin is an annual herbaceous plant that grows to a height of 20–30 cm. Its fruit is a lateral fusiform or ovoid achene, approximately 4–5 mm long, containing a single seed. The seeds are oblong, with longitudinal ridges, and are yellow-brown in color[24].	b-pinene, p-cymene, g-terpinene, and cuminaldehyde[25].
Milagu	Piperaceae	The pepper plant is a perennial climber that spreads as it grows. Its stem is broad with distinct nodes, reaching a height of up to 10 meters and forming a crown up to 1.5 meters in diameter. The seeds are smooth, measuring 3–4 mm in diameter, with a white or brown seed coat.[26]	Piperine and other phytochemicals such as amides, piperidine, pyrolidines, and trace amounts of safrole are present[27].
Vetrilai	Piperaceae	The betel leaf plant has a semi-woody, green stem with distinct joints and swollen nodes. Its leaves are dark green, glossy, and heart-shaped with a pointed tip. They are arranged alternately, simple in structure, and have smooth edges, measuring around 5–12 cm in length. The leaves emit a characteristic aroma due to the presence of essential oils, mainly eugenol and chavicol[28].	5-(2-propenyl)-1,3 benzodioxole (25.67%) followed by eugenol (18.27%) and 2-methoxy-4-(2-propenyl) acetate-phenol (8.0%), chavibetol (53.1%) and chavibetol acetate (15.5%)[29]. allypyrocatechol diacetate (0.71%), camphene (0.48%), chavibetol, methyl ester (methyl eugenol 0.48%), eugenol (0.32%), a-pinene (0.21%), ß-pinene (0.21%), a-limonene (0.14%), safrole (0.11%), 1,8-cineole (0.04%) and allypyrocatechol monoacetate[30].

KIRAMBU (*Syzygium aromaticum*)

The extract from *Syzygium aromaticum* was the most effective against gram-negative and multidrug-resistant uropathogens[36]. The putative antioxidant properties of clove have been investigated using ferric-reducing antioxidant power, oxygen radical absorbance capacity, 2,2-diphenyl-1-picrylhydrazyl (DPPH), 2,2'-azino-bis (3-ethylbenzothiazoline-6-sulfonic acid), xanthine oxidase, and 2-deoxyguanosine[37]. For the treatment and prevention of vaginal candida[38], eugenol and carvacrol may be effective antifungal agents. After being extracted from cloves, eugenol was tested against strains of the Herpes virus and shown to be effective[39]. Cloves' analgesic properties are attributed to eugenol[40].

MASIKKAI (*Quercus infectoria*)

Q. infectoria galls ethanolic extract has shown strong antibacterial action against Staphylococcus aureus and other pathogens. Microscopic examinations showed that after six hours of treatment, treated bacterial cells showed significant morphological changes, including total lysis and rupture. The possible use of Q. infectoria extract as a natural antibacterial agent[41] is suggested by these results. Gall extracts from Q. infectoria have been shown to have wound-healing qualities in recent investigations. In fibroblast cultures, the ethanolic extract was reported to reduce inflammation and oxidative stress, which accelerated wound closure[42]. Certain compounds, such hexagalloylglucose, that were isolated from *Q. infectoria* galls have been shown to have inhibitory effect against the enzyme α-glucosidase, which is involved in the digestion of carbohydrates. This inhibition modifies postprandial blood glucose levels[43], suggesting possible antidiabetic effects. A delay in the onset and a reduction in the intensity of tremorine-induced tremors are two indications of the modest anti-tremorine efficacy of *Q. infectoria* extracts. This implies that there may be uses for treating neurological conditions that cause tremors[44].

LAVANGA PATTAI (*Cinnamom verum*)

C. verum has strong antibacterial properties against a variety of diseases, such as viruses, fungi, and bacteria. Because of the effectiveness of its essential oils and extracts in preventing the growth of microorganisms, it may be a natural substitute for antibacterial agents[45]. Antioxidant property of the *C.verum* is widely known because of the significant amount of polyphenolic chemicals it contains. These antioxidants reduce oxidative stress by assisting in the neutralization of free radicals. Furthermore, *C. verum* has anti-inflammatory properties that could advance its therapeutic potential in the treatment of chronic inflammatory diseases[46]. Emerging research indicates that *C. verum* may possess neuroprotective properties[47].

SEERAGAM (*Cuminum Cyminum*)

In streptozotocin-induced rats, cuminaldehyde and cuminol from cumin seeds dramatically lower blood glucose levels[48]. The seeds of cumin exhibit strong antibacterial properties[49]. Oil from *Cuminum cyminum* destroyed 79% of Hela cells at a dose of 0.1 microl/ml and also demonstrated anticancer activity[50,51]. Rats with ovariectomies (OVX) showed the hypocholesterolemic impact of *Cuminum cyminum* (MCC) methanolic extract[51]. The analgesic and anti-inflammatory properties of *Cuminum cyminum* extracts were assessed using the cotton-pellet granuloma methodology, acetic acid-induced writhing, hot plate, and carrageenan-induced paw oedema. These trials showed a considerable reduction in inflammation and discomfort[52-55].

MILAGU (*Piper nigrum*)

The potential antibacterial and antifungal activities of piperine against *Staphylococcus aureus, Bacillus subtilis, Escherichia coli, Aspergillus niger, (A) flavus, Alternaria alternata,* and *Fusarium oxysporum* were reported by Rani et al[56]. According to Samykutty et al., piperine dramatically inhibited the proliferation of prostate cancer cells that were androgen-dependent and those that were androgen-independent[57]. De Souza and Mona et al reported that piperine has anticancer properties against osteosarcoma[58] and lung cancer[59]. According to Greenshields et al., in immune-deficient mice, piperine and γ-radiation together were more cytotoxic and effective than radiation alone at halting the proliferation of tripe negative cancer cells[60]. Jeena et al. found that black pepper essential oil reduced tissue lipid peroxidation[61] and scavenged superoxide, demonstrating antioxidant activity. Among its many other pharmacological properties are antihypertensive[62], antioxidant, analgesic, depressive, and anti-diarrheal[63] properties.

VETRILAI (*Piper betle*)

P. betle demonstrates strong antibacterial qualities and works well against a range of pathogens, such as parasites, fungus, and bacteria. These qualities are attributed to its phenolic components and essential oils, which have been demonstrated to prevent the growth of microorganisms and the production of biofilms. According to reports, *P. betle* contains gastro protective qualities that help to maintain digestive health and avoid stomach ulcers. Its immune modulatory activities also point to the possibility of strengthening immune responses and offering defense against a range of illnesses[64]. The plant's high concentration of phenolic chemicals, which scavenge free radicals and lessen oxidative stress, is the main cause of its antioxidant action. *P. betle* also has anti-inflammatory qualities, which helps to treat ailments linked to persistent inflammation[65]. Recent Studies have demonstrated that hydroalcoholic extracts of *P. betle* leaves possess significant analgesic effects. Experimental models have shown that these extracts can reduce pain responses, supporting traditional uses of the plant for pain relief[66]. Some research indicates that *P. betle* may have antidiabetic properties[67,68].

CONCLUSION

The present study highlights the potential of a Siddha-based herbal formulation as an effective alternative treatment for managing diarrhea in veterinary practice. The synergistic action of medicinal herbs, rich in bioactive compounds, contributes to the formulation's antimicrobial, anti-inflammatory, astringent, and gut-protective properties. These effects help to restore gastrointestinal balance, reduce excessive fluid loss, and promote faster recovery in affected animals. Compared to conventional synthetic drugs, the Siddha formulation offers a natural, cost-effective, and sustainable approach with minimal side effects, aligning with the growing demand for herbal veterinary medicine. Further in vivo studies and clinical trials are warranted to validate its efficacy, optimize dosage, and establish its safety profile across different animal species. Integrating traditional knowledge with modern veterinary science can pave the way for the development of holistic

and eco-friendly therapeutic solutions for livestock health management.

Source of Support: The author(s) received no financial support for the research, authorship, and/or publication of this article

Conflict of Interest: The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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