Overview of Herbal Treatment for Common Diseases in Ruminants

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Abstract

Ruminants are a unique group of mammals known for their specialized stomachs, which consist of four compartments: the omasum, reticulum, rumen, and abomasum. In India, animals like goats, sheep, cattle, and buffalo are essential to agriculture, significantly contributing to the economy. The livestock sector alone accounts for about 56.3% of agricultural worth and about 11% of the agricultural gross domestic product (AGDP). In rural areas, livestock farming is often a primary source of income for farmers, second only to crop production. To support this vital sector, the Pakistani government has launched various initiatives aimed at diversifying income sources and reducing the risk of farmer suicides caused by crop failures. However, many rural farmers struggle as a result of a lack of essential inadequacy in animal husbandry, which has resulted in the spread of diseases such as Foot and Mouth Disease (FMD), Hemorrhagic Septicemia (HS), and Black Quarter (BQ). These diseases can have devastating effects on livestock health and productivity. While conventional treatments typically rely on allopathic medicine, which can sometimes lead to unwanted side effects, herbal therapy is gaining popularity as a safe, accessible, and affordable alternative. This approach harnesses the therapeutically qualites of various plants to improve the health and productivity of livestock, offering a promising solution for the challenges faced by farmers in rural areas.

Keywords: Ruminant's, Economic, Agriculture, Livestock diseases, Herbal treatment

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Introduction

The group of mammals known as ruminants have compound stomachs, or stomachs with several compartments. Their stomach normally has four chambers: the omasum, reticulum, rumen, and abomasum. Because of their ability to provide goods, byproducts, and services that benefit human society, ruminants are the most widely tamed animals in India. This category of animals consists of goats, sheep, cattle, and buffalo. The Pakistani livestock production accounts for around 11% of the country's agricultural gross domestic product (AGDP) and 56.3% the total agriculture value. The annual growth rate of the GDP is 3.7% (Aziz, 1988). And livestock is 13.4% in the overall GDP over this period (Burki et al., 2004).

Agriculture's subsector is the livestock industry. It necessitates both a significant increase in countryside economic development and macroeconomic decisions for Pakistan's economy (Food & Organization, 2009). Rural areas of the nation typically raise livestock because these populations primarily rely on agriculture and related industries. The majority of these animals' population is found in rural areas because they are similar to the agriculture sector. Because of this, livestock are regarded by farmers in the countryside as their primary source of income after agriculture. The Pakistani government is also encouraging the keeping of livestock in rural regions through a number of programs, with the goal of combining farming to provide farmers with several sources of income and lower the occurrence of farmer suicides brought on by crop failure (Tarique et al., 2012).

Animals suffer from a number of diseases that reduce production efficiency and cost farmers money because rural populations lack fundamental knowledge about animal raising practices such as housing, spacing, proper sanitation, feeding methods, ventilation, and cleanliness. Numerous diseases, including viral infections such as FMD, HS, BQ, anthrax, tetanus, RP, PPR, blue tongue, and others, commonly affect these cattle. inadequate management techniques, polluted pasture, and lack of space, insufficient vaccination, and the mixing of both well- and ill animals on the area of pasture are the causes of these diseases (Madec et al., 2010). Animal diseases are usually treated with allopathic medicine; nevertheless, several adverse effects might result from dosage, delivery method, drug combinations, and anaphylactic reactions. One way to address these problems is through herbal therapy, which is accessible, affordable, and less likely to be dangerous. Numerous plant species found on the Asian Indian subcontinent offer medicinal qualities that people could employ to heal ailments in cattle.

Objective

- Assess the economic impact of ruminant diseases.
- Assess the bacterial and viral illnesses that are most common in ruminants.
- Compare the use of herbal and allopathic remedies.

- Examine how herbal medicine can help control illnesses.

Typical infectious diseases that impact ruminants fall under the following category: Viral illnesses and bacterial illnesses (Dhama et al., 2018).

1. FMD

FMD are a viral infection that can affect animals with split hooves, including cattle, pigs, sheep, goats, and wildlife. Given the potential for large financial and social losses, it presents one of the greatest threats to food security and livestock production for farmers and rural residents in Pakistan and other developing countries. Different types of FMD are caused by *Aphthovirus,* which are divided into seven primary groups: A, O, C, Asia 1, SAT 1, 2, and 3 (Rodríguez-Habibe et al., 2020). Finding the appropriate vaccine for each group might be challenging because these viruses can change their antigenicity (Biswal et al., 2019). Four FMD virus serotypes (O, A, C, and Asia-1) have been identified in Pakistan.

The disease results in fever, salivation, and blisters on the mouths, udders, and hooves of afflicted animals. Anorexia, mastitis, lameness, sadness, discomfort, and miscarriage can all result from blister ruptures (Amuthenu, 2015). FMD is mainly spread by direct or indirect contact with sick animals or their bodily fluids. People, animals, and the surroundings can all spread viruses (Mielke & Garabed, 2020). By avoiding contact with contaminated animals and their products as well as by utilizing the proper disinfection techniques, FMD can be avoided. FMD has no known cure; the only available treatment is supportive care with antibiotics and anti-inflammatory medications (Younus et al., 2019). FMD can be treated traditionally by putting honey or finger millet (ragi) flour on the lesions or by washing them with a solution of natural soda ash (khar). Additional research has confirmed the application of these conventional treatments to treat ulcers and wounds (Gakuya et al., 2011). Antiviral substances found in plants are abundant and can target several kinds of DNA and RNA viruses. Numerous antiviral compounds, including coumarins, glycosides, lignans, saponins, polyines, thiophenes, proteins, polyphenols, flavonoids, alkaloids, and polysaccharides, are found in plants (Zeedan & Abdalhamed, 2021). The following herbal treatment, which is listed in Table 1, can be used for FMD instead of the aforementioned allopathic regimen.

Table 1: Medicinal Plants with Antiviral and Anti-Inflammatory Properties for Foot-and-Mouth Disease (FMD) Treatment

Plant & Local Name	Family	Properties	Use	References
Azadirachta Indica (Neem)	Meliaceae	Antiviral, antibacterial, and anti-inflammatory	Many phytochemicals with a range of biological and pharmacological properties can be found in the leaves, bark, seeds, flowers, fruits, and roots of the neem tree. Extracts from neem bark or leaves are frequently used to treat FMD lesions and lower the viral load.	(Alzohairy, et al., 2016)
Moringa oleifera (Sonjna)	Moringaceae	Antiviral, antimicrobial,	widely used for its various health benefits. *Moringa oleiferais* a plant that has been used to treat FMDV lesion in animals. It has various phytochemicals and other components, that may have antiviral activity against FMDV	(Biswas, et al., 2020)
Curcuma longa (Turmeric)	Zingiberaceae	immune-stimulant, antiviral, and anti-inflammatory	Turmeric's main ingredient, curcumin, aids animals with FMD by boosting their immune systems and lowering inflammation.	(Aggarwal & Harikumar, 2009)
*Allium sativum (*Garlic)	Alliaceae	Anti-inflammatory, wound healing, and antiviral.	Allium sativum extract and its organ sulfur compounds (OSCs) can act against FMD virus by interfering with its replication, modulating the immune system, and enhancing the vaccine response	(Shakoor, et al., 2014)
Vitex negundo L. (Nirgundi, Sephali)	Verbenaceae	Anti-inflammatory	used to treat inflammation, swelling, and pain	(Das et al., 2018)
Tertulia urens	Malvaceae	Anti-inflammatory, wound healing	Used to treat wound healing, inflammation	(Mabberley, 2017)

2. Hemorrhagic Septicemia (HS)

Hemorrhagic septicemia (HS), an acute, fatal and septicemic disease of cattle and buffaloes caused by Pasteurella multocida, is important in tropical regions of the world, especially in African and Asian countries(Shivachandra *et al.*, 2011). The initial symptoms could include a temperature, lethargy, and a reluctance to move. The path gnomic clinical symptom is edematous swellings in the submandibular region, together with salivation and a heavy, serous nasal discharge. This condition is commonly referred to as neck inflammation disease. Death may also occur suddenly or develop gradually over a few days. Clinically ill animals, especially buffalo, seldom get better. Similar symptoms have been observed in certain wild ruminants with systemic Pasteurella's, including acute respiratory distress with foamy nasal discharge, edema of the head, neck, and brisket, excessive salivation, and extreme depression. Africa, the Middle East, and South-East Asia are examples of tropical regions. In these nations, it is consistently seen as having significant economic significance (Michael et al., 2021). Likewise, HS causes a huge economic loss in Pakistan, accounting for about 350 million USD every year (Michael et al., 2021).

According to a report conducted by the German company for technical cooperation, GTZ, HS is anticipated to lose PKR 2.17 billion year, with Punjab bearing the brunt of this liability. HS is the most economically significant disease as a result of these losses. Additionally, it was stated that if 50% of the monetary losses resulting from HS are eliminated by implementing preventative measures like as immunization, the lack of cattle output and the items they provide can be overcome to make up for the human population's shortfall.

In Pakistan, water buffaloes are reported more prone to HS as compared to cattle (Zafar et al., 2012). Despite concerted efforts to progress science, HS has consistently posed a barrier to scientists and caused annoyance to veterinary professionals. It has long been recognized that the lysis of *P. multocida* results in the excretion of lipopolysaccharide (LPS), commonly referred to as endotoxin, which causes the disease's clinical

symptoms *(Zafar et al., 2012)*. Typical treatment regimens for HS include 10 mg/kg I/V of oxytetracycline (LA), 100 mg/kg I/V of sulfadimidine, 30-45 thousand IU/kg I/M of procaine penicillin, 3 ml/45 kg I/M of trimethoprim sulfadoxine, 10 mg/kg S/C of tilmicosin, or 20 mg/kg I/M of florfenicol. The following herbal treatment, which is listed in Table 2, can be used for HS instead of the aforementioned allopathic regimen.

Table 2: Medicinal Plants with Antibacterial and Immune-Boosting Properties for Hemorrhagic Septicemia (HS) in Livestock

Plant & Local Name	Family	Properties	Use	References
Calpurnia aurea	Fabaceae	powerful antiviral, antibacterial, and anti-inflammatory properties	Animal feed can be supplemented with powdered *Calpurnia aurea* dried fruit to prevent bacterial infections.	(Tekle, 2014)
Moringa oleifera	Moringaceae	antimicrobial, antioxidant, and immune-stimulating	Grounding the leaves and pods and adding them to food can boost the immune system and reduce the bacterial burden.	(Mbikay, 2012)
***Zingiber officinale* (Ginger)**	Zingiberaceae	Antioxidant, antibacterial, and anti-inflammatory properties that reduce inflammation and help manage bacterial infections.	Livestock can benefit from ginger extract or powder to boost immunity and lower the number of bacteria during HS.	(Ali et al., 2008)
Capsicum annuum L.	Solanaceae	Anti-inflammatory, antioxidant,	The bacterial load may be reduced by capsicum annuum's antibacterial properties, especially with regard to *Pasteurella multocida*, the pathogen that causes HS.	(Srinivasan, 2016)
Vernonia amygdalina Del.	Asteraceae	anti-inflammatory, and antioxidant qualities	Typically, the leaves of Vernonia amygdalina are either dried, powdered, and added to animal feed, or they are cooked to create a decoction. This reduces bacterial infection and boosts immune function in animals with HS.	(Farombi & Owoeye, 2011)

3. Black Quarter (BQ)

The infectious bacterial disease known as "black quarter" is caused by the rod-like, anaerobic, Gram-positive bacteria *Clostridium chauvoei*, which can form environmentally persistent spores in poor settings. Spores of bacteria, such as Clostridium species, can lie dormant in soil for years. When grazing cattle consume these spores, especially from contaminated pastures, they become active and infect the big muscles, where the bacteria multiply and release gas. This results in illnesses like blackleg, when tissue death happens and blisters packed with gas form in the muscle. The bacteria are present naturally in soil and digestive tracts of animals, and outbreaks frequently continue in places where soil or feces infection is present (Busch et al., 2000). The most significant losses from blackleg occur in cattle around the ages of 6 months and two years (Sarah, 2013).

Cattle that eat a lot of grain and have healthy bodies are generally more vulnerable to Blackleg, an infection caused by *Clostridium chauvoei*. Despite the fact that heavy exercise and bruises may cause the condition to develop, it frequently advances without any prior history of injuries. Although older cattle can occasionally get blackleg, the disease mostly affects cattle under the age of two because of their comparatively underdeveloped immune systems. In these instances, using needles repeatedly for injections has been linked to epidemics. If calves under four months old do not obtain enough passive immunity from colostrum, they may also be impacted (Verma et al., 2023). Severe toxemia and gaseous edema of the skeletal muscle are two of the disease's hallmarks Animals can be effectively protected by a vaccination, even though the sickness is acute and treatment is challenging. The affected limb may feel hot to the touch when the animal first develops a fever. Penicillin (LA) at 40,000 IU/kg I/M. and antiserum are common therapy protocols used to treat BQ. The following herbal treatment, which is listed in Table 3, can be used for BQ instead of the aforementioned allopathic regimen.

4. Anthrax

Anthrax is a worldwide zoonotic disease caused by the spore-forming, gram-positive organism *Bacillus anthracis*. Although many animals can become infected, grazing herbivores are the most frequently impacted and the typical human source of infection. During grazing, herbivores frequently pick up *B. anthracis* spores from the soil, which they subsequently return to the soil after they have died. Depending mostly on the soil's composition and climate, the spores can remain in the soil for decades (Carlson et al., 2019). The first bacteria identified by microbiologist Robert Koch in 1876 is *Bacillus anthracis*, the causal culprit. This bacterium is unique in that it may live for years in the environment in two different life forms: the latent spore form and the vegetative bacillary form (Bakhteeva & Timofeev, 2022).

Whereas spores are created in oxygenated, nutrient-limited settings, usually outside of a host, the active vegetative form flourishes in nutrient-rich habitats, such as the mammalian body. Humans and animals can inhale, eat, or come into contact with anthrax spores through their skin (Sabra et al., 2023). Anthrax infection can present in several forms depending on how the spores enter the body: either inhaled, gastric, or cutaneous. More than 95% of anthrax infections worldwide occur in the cutaneous form, which is typically brought on by close contact with diseased animals or tainted animal products like skins, wool, or bone. Since anthrax spores have low invasiveness, infection through the skin generally occurs only when there are cuts or abrasions. Rarely, anthrax may also be transmitted by insect bites (Bradarič & Punda-Polič, 1992).

The cutaneous form of anthrax typically develops 2–5 days (with a range of 1–7 days) after exposure, most often on exposed skin areas like the forearms and shins. It presents as a distinctive, painless blackened lesion with a raised, rounded edge. This lesion, known as an eschar, is surrounded by swelling but generally lacks pus or significant pain (Adan, 2022). The gastrointestinal and pulmonary variants of the disease are rare and often fatal, especially when they affect the lungs. Because it is so uncommon, whenever additional incidents of inhalation anthrax

occur, there should always be worry about the chance for a bioterrorist assault. The most recent two pulmonary anthrax outbreaks were both caused by non-natural causes (Christian, 2013). In 1979, an accidental release of anthrax spores from a Soviet bioresearch facility in Sverdlovsk, Russia, led to an inhalation anthrax outbreak, resulting in 96 human cases. More recently, in 2001, the last major inhalation anthrax outbreak occurred in the United States following a bioterror attack, which involved the intentional release of spores through the mail system.

Table 3: Medicinal Plants with Antibacterial and Anti-Inflammatory Properties for Disease Management

Plant & Local Name	Family	Properties	Use	References
Ruta chalepensis (Pismaram)	Rutaceae	Anti-inflammatory, antispasmodic, antimicrobial and antioxidant,	The plant's extracts or infusions can be taken orally for its anti-inflammatory and systemic antibacterial properties.	(Gidey Yirga et al., 2012)
Pergularia extensa	Asclepiadaceae	Antibacterial, anti-inflammatory,	Because of its potent antibacterial properties, *pergularia extensa* may be able to lessen the number of germs present in diseased muscles. Additionally, it is recognized to strengthen the lessen inflammation.	(Santhivimala rani and Pavadai, 2014)
Lobelia giberroa (Tabaco plant)	Campanulaceae	antimicrobial, immunomodulatory, and anti-inflammatory. Respiratory assistance,	To improve general health and strengthen the immune system, tinctures or infusions could be used.	(Tekle, 2014)
Curcuma longa (Turmeric)	Zingiberaceae	Anti-inflammatory, antioxidant, antimicrobial.	The main ingredient in turmeric, curcumin, possesses potent antibacterial and anti-inflammatory properties. It may help manage bacterial infections and lessen muscle inflammation.	(Singh, 2020)
Allium sativum (Garlic)	Amaryllidaceae	Antibacterial, antiviral, antifungal, and immune-boosting	Allicin, a substance with strong antibacterial properties, is found in garlic. By strengthening immunity and increasing general resistance to infections, it may aid in the battle against bacterial infections.	(Bhatwalkar et al., 2021)

There are two types of clinical courses: acute and chronic. The per acute type, which is prevalent in sheep and cattle, is distinguished by its abrupt onset and swiftly demise. Even with only a brief indication of disease, cattle, sheep, or goats may experience staggering, dyspnea, shaking, collapse, a few convulsive jerks, and death. A sudden fever and a time of excitation are followed by depression, lethargy, respiratory or cardiac discomfort, shocking seizures, and death in cases of acute anthrax in sheep and cattle. Pregnant animals may abort, rumination stops, milk production is significantly decreased, and body temperature may rise to 107°F (41.5°C). After death, bloody discharges may come from the natural bodily holes. Localized, subcutaneous, and sometimes fairly widespread edematous swelling is a characteristic of certain illnesses. The ventral neck, thorax, and shoulders are the region's most commonly affected (Stefos et al., 2012).

Table 4: Medicinal Plants with Antibacterial and Anti-Inflammatory Properties for Anthrax Management

Plant & Local Name	Family	Properties	Use	References
Ocimum sanctum (Holy Basil)	Lamiaceae	Antimicrobial, and anti-inflammatory	Because of its immune-boosting qualities, holy basil may help people recover from bacterial illnesses.	(Cohen, 2014)
Boscia coriacea Pax	Capparidaceae	Antibacterial, antiviral, and anti-inflammatory	Various parts of the plant, including the stem bark, roots, and leaves, are utilized to treat ailments such as body pains, ear problems, respiratory infections, and fever.	(Giday and Teklehaymanot, 2013)
Curcuma longa (Turmeric)	Zingiberaceae	antibacterial, anti-inflammatory, and antioxidant.	Anthrax and other bacterial infections may benefit from turmeric's ability to boost immunity and reduce swelling.	(Aggarwal & Harikumar, 2009)
Glycyrrhiza glabr	Fabaceae	Anti-inflammatory and antimicrobial.	The traditional usage of licorice root to reduce infections and strengthen immunity may offer supportive care.	(Asl & Hosseinzadeh, 2008)
Echinacea	Asteraceae	Antimicrobial, anti-inflammatory, and immune-stimulating	Echinacea is frequently used to combat bacterial infections and boost immunity.	(Goel et al., 2004)

The standard treatment regimen for anthrax is 20,000 IU/kg I/M. BID for penicillin, 8–10 g/day in two I/M doses for streptomycin, 5 mg/kg I/V for oxytetracycline, and 100–250 ml of serum per day for five days. The following herbal treatment, which is listed in Table 4, can be used for Anthrax instead of the aforementioned allopathic regimen

5. Actinobacillosis

Actinobacillus is a genus of gram-negative coccobacillus that causes a particular infectious disease called Actinobacillosis. Known by most as wooden tongue, the disease is mainly associated with *Actinobacillus lignieresii*. The development of pus-filled granulomas containing tiny, firm, yellow to white granules is a characteristic of this illness. Animals and occasionally people can contract a variety of illnesses from other

Actinobacillus species (e.g. *A. actinoides, A. suis, A. pleuropneumonia and A. equuli*) are also pathogens affecting soft tissue (Kish et al., 2014).

In cattle, Actinobacillosis primarily targets the tongue, leading to a condition known as "wooden tongue," as well as the lymph nodes in the head and neck. The main feature of this disease is the formation of granulomas on the tongue, which can discharge pus. Infections often start with sudden, acute inflammation, causing difficulty in eating or drinking for several days, excessive drooling, rapid weight loss, and a painful, swollen tongue with nodules and ulcers (Albornoz & Sali, 2012).

The chronic bacterial illness known as Actinobacillosis can seriously affect livestock. Because they have trouble swallowing or moving their tongues, the afflicted animals may die from malnutrition or dehydration during the acute phase. When an illness reaches a chronic phase, fibrous tissue develops, which makes it harder for the animal to feed since the tongue becomes smaller and less mobile. Abscesses may form and release pus that may contain granules when local lymph nodes swell in certain situations (Quinn et al., 2011). The following treatment protocols are commonly used to manage Actinobacillosis:

- **Potassium iodide**: 6–10 grams per day administered orally for 7–10 days.
- **Sodium iodide**: 1 gram per 12 kg of body weight given intravenously as a single dose.
- **Streptomycin**: 5 grams per day administered intramuscularly for 3 days.
- **Isoniazid**: 10 mg per kg of body weight administered intramuscularly for 3–4 weeks.

Actinobacillosis can be treated with the herbal remedy indicated in Table 5 instead of the previously mentioned allopathic regimen.

Table 5: Herbal Remedy for Actinobacillosis

Plant & Local Name	Family	Properties	Use	References
Calendula	Asteraceae	Well-known for its ability to reduce inflammation and heal wounds	used to afflicted regions as a salve or topical treatment.	(Preethi & Kuttan, 2009)
Calotropis procera	Asclepiadaceae	Antimicrobial activity, Anti-inflammatory, Anti parasitic activity.	Used for treating wounds, parasitic infections, and latex applied to swollen joints	(Gidey Yirga *et al.*, 2012)
Acmella caulirhiza Del.	Asteraceae	Antimicrobial Activity, Anti-inflammatory and Analgesic Effects, Antioxidant Properties	Used for treating oral and skin infections. Traditionally used for toothaches, gum infections, and mouth ulcers	(Tekle, 2014)
(*Azadirachta indica*)		Neem has strong antibacterial and antifungal properties.	You can use neem oil or leaves directly on afflicted regions or as an oral rinse.	(Subapriya & Nagini, 2005)

Prospects of Herbal Medicine in Ruminant Disease control

The therapeutic efficacy, accessibility, and long-term availability of herbal remedies make it a promising option for controlling ruminant diseases. Herbal alternatives present a viable answer to the growing problem of antimicrobial resistance by lowering reliance on synthetic medications. Livestock disease resistance can be increased by the immunomodulatory, antibacterial, and antiparasitic qualities of several medicinal herbs. Additionally, herbal remedies are frequently more readily available and reasonably priced, especially for farmers in areas with low resources. Veterinary formulations that are standardized and scientifically confirmed may result from ongoing research into plant-based substances. Furthermore, using herbal medicine into traditional veterinary care helps minimize environmental effect while promoting sustainable cattle health management.

Conclusion

Ruminant disorders have a substantial effect on the financial viability and production of livestock, especially in nations like Pakistan, where livestock is an important agricultural industry. High rates of morbidity and mortality in common infectious diseases, including anthrax, hemorrhagic septicemia (HS), foot-and-mouth disease (FMD), and black quarter (BQ), result in tremendous economic losses. Despite their effectiveness, traditional allopathic medicines frequently have drawbacks, such as side effects, antibiotic resistance, and exorbitant prices. Herbal medicine, on the other hand, offers a good substitute because of its accessibility, low cost, and few adverse effects. Numerous herbal remedies have significant antiviral, antibacterial, and anti-inflammatory qualities that may help treat various illnesses. Herbal medicine research and application in veterinary care can enhance disease control, lessen reliance on synthetic medications, and support long-term animal health.

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