Indian Farming 75 (06): 22-25; June 2025

National strategy for the control of

Fasciola gigantica in ruminant livestock

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Fasciola gigantica, a liver fluke, is an important parasitic infection affecting ruminants in India. It has far-reaching consequences for the productivity of livestock, particularly in regions where environmental conditions favour lifecycle of the parasite. The economic burden of fascioliasis is immense, resulting in reduced meat and milk production, growth retardation in young animals, increased veterinary costs, and, in severe cases, death.This manuscript provides the insight on the current status of fascioliasis in India, identifies critical gaps in existing policies, and outlines recommendations for a comprehensive strategy to mitigate the impact of F. gigantica in ruminants.

Keywords: Control, *Fasciola gigantica*, Policy, Recommendation, Ruminants

INDIA is home to one of the largest livestock population in the world, with cattle, buffaloes, sheep, and goats forming the backbone of rural economy. Livestock farming not only provide a source of income through the sale of milk, meat, and wool but also contribute to the overall food security of millions of smallholder farmers. The dairy industry, in particular, plays a pivotal role in the national economy, making India the world's largest producer of milk. Additionally, livestock provide manure for crop farming, draught power, and financial security to rural households. However, parasitic infections such as fascioliasis pose a major challenge to maintaining healthy livestock population.

Fasciola gigantica is a parasitic flatworm (fluke) that primarily affects the liver and bile ducts of ruminants. Fascioliasis has a widespread impact on livestock productivity across tropical and subtropical regions, including India, where climatic conditions and the availability of water bodies create ideal conditions for the spread of the disease. Its lifecycle is complex and understanding it is essential for developing effective control measures. It involves two distinct hosts: the definitive host, which includes various ruminants such as cattle, buffaloes, sheep, and goats, and the intermediate host, primarily freshwater snails. Involvement of both of these hosts is crucial for the completion of the parasite's lifecycle. *F. gigantica* begins its lifecycle within ruminants as eggs, which are excreted in the faeces. When these eggs come into contact with freshwater environments, they hatch into motile larvae called miracidia. These miracidia infect the appropriate freshwater snails, which serve as an intermediate host. Once inside the snail, the miracidia undergo several developmental stages, transforming into sporocysts, rediae, and ultimately, cercariae. These cercariae are then released from the snail into the water, where they encyst to form metacercariae on vegetation or in the substrate. Ruminants get infected when they ingest these metacercariae while grazing on contaminated grass or drinking infested water.Upon ingestion, the juvenile flukes are liberated from their cysts in the digestive tract and migrate through the intestinal wall into the liver. This migration can be particularly damaging, as the juvenile flukes burrow through liver tissue, causing significant inflammation and necrosis. As the flukes inhabit the liver, they can severely impair

Adult (a) and immature (b) *Fasciola gigantica*

its ability to perform essential functions, including the synthesis of proteins and the detoxification of metabolic waste. Infected animals suffer from liver damage, reduced feed conversion efficiency, chronic weight loss, anemia, jaundice, and, in extreme cases, death. Chronic infections often lead to a range of debilitating health issues in affected animals. For instance, infected ruminants frequently exhibit slower growth rates due to reduced feed efficiency, as the liver's impaired function limits nutrient absorption and metabolism. Additionally, the stress of the infection can lead to reduced milk production in dairy cattle and goats, negatively affecting the economic viability of livestock farming. Fertility issues may also arise as chronic liver damage can disrupt hormonal balance and reproductive health. The successful completion of this lifecycle depends on favourable environmental conditions, particularly the availability of standing water and snail population. Pastures with waterlogged areas, especially in tropical regions of India, provide an ideal breeding ground for the intermediate hosts, facilitating the transmission of the parasite.

Prevalence of fascioliasis in India

It is endemic in areas with high rainfall and significant bodies of stagnant water as it ensures presence of intermediate snail hosts essential for the life cycle of *F. gigantica*. In Southern India, states like Kerala, Tamil Nadu, and Karnataka report particularly high prevalence rates, often exceeding 70% during monsoon season due to the abundance of waterlogged pastures, swamps, and rivers that support the growth of freshwater snails. Similarly, eastern states such as West Bengal, Assam, Meghalaya, and Arunachal Pradesh show infection rates ranging between 40% and 80%, driven by their humid climates and abundant water bodies that facilitate snail proliferation, significantly impacting the livelihoods of local farmers who rely on livestock. In northern and Central India, Uttar Pradesh, Bihar, and Madhya Pradesh, moderate to high prevalence rates are observed, especially in regions with irrigation canals and flooded pastures, further compounding the economic challenges faced by farmers in these areas due to reduced productivity and increased veterinary costs. Overall, the varying prevalence of fascioliasis across India highlights the urgent need for targeted control measures and awareness programmes to mitigate the detrimental effects of this parasitic infection on livestock health and farmer livelihoods.

Economic impact on livestock and farmers

The economic burden of fascioliasis on the livestock industry in India is significant, affecting not only individual farmers but also the broader agricultural economy. One of the most immediate consequences of the disease is reduced productivity among infected animals. Ruminants suffering from fascioliasis exhibit slower weight gain and lower feed efficiency, meaning that they require more feed to achieve the same growth rates as uninfected animals. This inefficiency translates directly into financial losses for farmers, who must invest more in feed without realizing proportional gains in weight or milk production. Dairy animals, particularly cattle and buffaloes, are especially vulnerable; chronic liver damage resulting from infection severely hampers their milk yield. In some regions, farmers report 10%–25% reductions in milk production, which can have a cascading effect on their household income and food security.

Moreover, the economic impact extends to the processing stage of livestock management. Infected animals often have their livers condemned at slaughterhouses due to the presence of flukes, leading to direct financial losses for farmers who are unable to sell these organs. This not only diminishes the overall value of the livestock but also increases the loss of potential revenue that could have been derived from meat sales. The condemnation of livers is particularly detrimental for farmers who rely on every part of the animal for their livelihood, including offals, which are a significant source of income.

In addition to the direct losses from reduced productivity and condemned livers, farmers also face increased veterinary costs. Repeated anthelmintic treatments, consultations with veterinarians, and diagnostic tests creates a financial burden that can be overwhelming, particularly for smallholder farmers with limited resources. These recurring expenses can lead to a cycle of debt, as farmers may struggle to afford the necessary interventions to maintain their herds. The mortality and morbidity associated with severe cases of fascioliasis further exacerbate the economic strain on farmers. Young animals are particularly susceptible to the disease, and losses due to death can significantly impact a farmer's breeding stock. This loss not only represents a direct financial hit but also reduces the future productivity potential of the farm, affecting long-term sustainability and growth. Addressing these economic challenges through effective management strategies, improved veterinary care, and farmer education is crucial for mitigating the adverse effects of fascioliasis on the livestock industry.

Existing control measures and policy framework

The management of *F. gigantica* in ruminants in India heavily relies on the use of anthelmintics, specifically triclabendazole, closantel, and albendazole. These medications are essential in treating fascioliasis; however, their application in the field is fraught with challenges that significantly hinder effective disease control. One of the major issues is inconsistent dosing. Many farmers administer these anthelmintics without proper veterinary guidance, often relying on personal experience or anecdotal evidence rather than scientific recommendations. This lack of professional oversight frequently results in improper dosing, where the medication is either underdosed or overdosed. Under-dosing fails to

eliminate the parasite completely, allowing it to survive and contribute to ongoing infections. Over-dosing, on the other hand, can lead to toxicity and adverse health effects in the livestock. Such practices foster an environment where incomplete parasite clearance becomes the norm, exacerbating the issue of drug resistance.

Moreover, there is increasing concern about the emergence of drug resistance among *F. gigantica* population in India. Studies have shown that resistance, particularly to triclabendazole, is on the rise. This phenomenon is largely attributed to the frequent and indiscriminate use of the same classes of anthelmintics without adequate rotation or integration of alternative control strategies. As resistance develops, it limits the efficacy of the available treatment options, creating a vicious cycle where higher doses or more potent drugs are required, further perpetuating the cycle of resistance. This situation necessitates immediate action, as the long-term sustainability of fascioliasis management is at stake.

Challenges in fascioliasis control

India's veterinary infrastructure, while extensive and encompassing a wide range of services, faces several significant challenges that hinder effective control of fascioliasis. These challenges contribute to the ongoing prevalence and impact of the disease on livestock health and farmer livelihoods. One of the critical issues plaguing the veterinary infrastructure is the lack of accessible diagnostic facilities, particularly in rural areas. Diagnostic tools such as fecal examination and immunological assays like enzyme-linked immunosorbent assays, which are essential for accurate and timely identification of *F. gigantica* infections, are often unavailable or underutilized. This unavailability results in delayed diagnoses and treatment interventions, allowing the disease to progress and spread unchecked within livestock population. Without prompt and accurate diagnostic capabilities, farmers are unable to make informed decisions regarding treatment and management, further exacerbating the situation.

Most smallholder farmers in India have limited knowledge about fascioliasis and its impact on livestock health and productivity. The majority of farmers are unaware of the parasite's lifecycle, the role of snails as intermediate hosts, and the environmental factors that contribute to disease transmission. As a result, farmers often delay seeking veterinary care or fail to implement preventive measures such as pasture management and snail control. Climate change is likely to exacerbate the spread of fascioliasis in India. Rising temperatures, increased rainfall, and more frequent flooding events create ideal conditions for the proliferation of freshwater snails, which serve as the intermediate hosts for *F. gigantica.* Furthermore, climate change may lead to the expansion of fascioliasis into new geographic regions that were previously unaffected by the disease.

One of the most significant challenges in controlling fascioliasis is the emergence of anthelmintic resistance, particularly to drugs like triclabendazole, which is primarily driven by the overuse and misuse of anthelmintics, characterized by incorrect dosing and improper treatment intervals, leading to the selection of resistant parasite strains. Although current control efforts predominantly focus on the administration of these drugs, they often lack a comprehensive strategy that integrates integrated parasite management methods.

Strategies in fascioliasis control

To effectively control fascioliasis, a multifaceted approach is essential, combining various strategies to address the underlying factors that contribute to the disease's spread. Environmental management plays a crucial role in controlling the snail population. One effective strategy is to improve drainage in waterlogged areas, which can significantly reduce the availability of suitable habitats for these snails. By altering the landscape to minimize stagnant water, farmers can disrupt the life cycle of the parasite and diminish the risk of infection among livestock. Such environmental modifications not only help control fascioliasis but also contribute to the overall health of the ecosystem by reducing the prevalence of other waterborne diseases. In addition to environmental management, grazing management practices can significantly reduce livestock exposure to contaminated pastures. Implementing rotational grazing systems allows farmers to alternate grazing areas, thereby giving previously grazed pastures time to recover and reducing the accumulation of parasite larvae in the environment. This practice not only helps minimize the risk of reinfection but also promotes healthier pastureland and more sustainable livestock production. Educating farmers about effective grazing management techniques is essential for the successful implementation of this strategy. Furthermore, biological control presents a promising avenue for managing fascioliasis by introducing natural predators of freshwater snails into affected areas. For instance, integrating ducks or certain fish species into livestock systems can help keep snail population in check. These natural predators consume snails and, consequently, can lower the transmission rates of the parasite. This method not only reduces reliance on chemical treatments but also enhances biodiversity within farming systems, contributing to a more resilient agricultural environment.

Recommendations for policy reform

Promoting farmer education and extension services is equally important. Developing a comprehensive education programme will raise awareness about fascioliasis and encourage the adoption of preventive measures. This programme should include training workshops on integrated parasite management, educating farmers on pasture management, rotational grazing,

and snail control. Community-based health initiatives should be encouraged by establishing farmer groups and cooperatives, while outreach campaigns using mass media can effectively disseminate information about the risks of fascioliasis and protective measures for livestock. Implementing integrated parasite management is essential for the sustainable control of fascioliasis. Key components of an integrated parasite management strategy include environmental management, such as improving drainage systems in waterlogged areas to reduce snail habitats; biological control by introducing natural predators of snails, such as ducks and fish; grazing management through rotational grazing practices to limit exposure to contaminated pastures; and the use of organic dewormers to help reduce the parasite burden without contributing to drug resistance.

SUMMARY

Fasciola gigantica poses a significant threat to India's livestock sector, with extensive repercussions for rural livelihoods and the national economy. However, through the implementation of effective strategies and interventions, it is possible to control the spread of this disease and mitigate its detrimental impact on ruminants, and India can safeguard its livestock from the severe consequences of fascioliasis, enhance livelihoods of smallholder farmers, and solidify its status as a global leader in the dairy and meat industries.

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