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Epidemiology and Control of Gastrointestinal Parasites in Ruminants

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Abstract

Gastrointestinal (GI) parasites are among the most persistent and economically damaging pathogens affecting ruminant livestock worldwide. These parasites—including nematodes, cestodes, and protozoa—reduce productivity through poor growth, anemia, and decreased milk yield. Epidemiological patterns are shaped by complex interactions among host factors, environmental conditions, and management systems. Recent studies report prevalence rates exceeding 80–90% in many regions, highlighting the continuing burden of parasitism in both developing and developed livestock systems. The emergence of anthelmintic resistance and climate-driven changes in parasite distribution further complicate control efforts. This article presents an overview of the epidemiology, risk factors, and integrated control strategies for gastrointestinal parasites in ruminants, emphasizing sustainable and climate-smart approaches.

Keywords: Gastrointestinal parasites, Ruminants, Epidemiology, Anthelmintic resistance, Integrated parasite management

1. Introduction

Gastrointestinal parasitism remains a major constraint to efficient ruminant production systems. Parasites such as *Haemonchus*, *Trichostrongylus*, *Ostertagia*, *Eimeria*, and *Moniezia* are widely distributed across agro-climatic regions. Their impact extends beyond animal health to food security and rural livelihoods.

Recent epidemiological surveys confirm that GI parasites are highly prevalent in cattle, sheep, and goats, often occurring as mixed infections. For instance, prevalence rates of over 90% have been reported in small ruminants, with strongyle nematodes being the dominant group (Kaur et al., 2025). These infections significantly impair productivity, making parasite control a priority in veterinary health management.

2. Epidemiology of Gastrointestinal Parasites

2.1 Prevalence and Distribution

The prevalence of GI parasites varies geographically but remains consistently high. A study in Gabon reported an overall prevalence of 91.7% in sheep and goats (Mapagha et al., 2025). Similarly, research in India documented widespread infections dominated by strongyle species (Anish et al., 2026).

Strongyles, particularly *Haemonchus contortus*, are the most prevalent and pathogenic parasites in tropical regions, while protozoa such as *Eimeria* also contribute significantly to disease burden (González et al., 2026).

2.2 Host Factors

Host-related variables strongly influence parasite epidemiology:

- **Age:** Young animals are more susceptible due to immature immunity.
- **Sex:** Males often exhibit higher infection rates compared to females.
- **Physiological status:** Pregnant animals show increased susceptibility due to immune suppression.

Studies have shown that juvenile animals may have higher infection prevalence, while adults often carry heavier parasite burdens (Mapagha et al., 2025).

2.3 Environmental and Climatic Factors

Environmental conditions such as temperature, humidity, and rainfall directly influence parasite development and transmission. Warm and humid climates favor rapid development of infective larvae on pasture.

Recent research highlights the role of climate change in altering parasite epidemiology by extending transmission seasons and expanding geographic distribution (Saha, 2026). Seasonal variations are particularly important, with peak infections often observed during monsoon or rainy seasons (Kaur et al., 2025).

2.4 Management and Husbandry Practices

Management practices play a crucial role in parasite transmission:

- **Extensive grazing systems** increase exposure to infective larvae.
- **Poor sanitation** leads to environmental contamination.
- **High stocking density** enhances transmission rates.

Studies indicate that animals raised under extensive systems have significantly higher parasite burdens compared to those under intensive management (Mapagha et al., 2025).

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3. Pathogenesis and Economic Impact

GI parasites cause disease through multiple mechanisms, including:

- Blood loss (e.g., *Haemonchus contortus*)
- Nutrient competition
- Damage to intestinal mucosa

These effects lead to anemia, diarrhea, weight loss, and reduced productivity. Economically, parasitic infections result in decreased milk yield, reduced growth rates, and increased mortality.

The cumulative economic impact is substantial, particularly in developing countries where livestock is a primary livelihood source (Rufino et al., 2025).

4. Diagnosis of Gastrointestinal Parasites

Accurate diagnosis is essential for effective control. Common diagnostic methods include:

- **Fecal egg count (FEC)** techniques (e.g., McMaster method)
- **Flotation and sedimentation methods**
- **Larval culture techniques**

Advanced diagnostic tools such as molecular methods and PCR-based assays are increasingly used for precise parasite identification (González et al., 2026).

5. Control Strategies

5.1 Chemotherapeutic Control

Anthelmintics remain the primary tool for controlling GI parasites. Common drug classes include:

- Benzimidazoles
- Macrocyclic lactones
- Imidazothiazoles

However, widespread misuse has led to the emergence of drug resistance. Studies report reduced efficacy of commonly used drugs such as fenbendazole and ivermectin (Kaur et al., 2025).

5.2 Integrated Parasite Management (IPM)

Sustainable control requires integrated approaches:

a. Grazing Management

Rotational grazing reduces pasture contamination and interrupts parasite life cycles.

b. Nutritional Management

Improved nutrition enhances host immunity and reduces susceptibility.

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c. Biological Control

Use of nematophagous fungi to control larval stages is gaining attention.

d. Targeted Selective Treatment (TST)

Treating only heavily infected animals reduces drug use and slows resistance development.

5.3 Genetic and Immunological Approaches

Selective breeding for parasite resistance is a promising strategy. Indigenous breeds often show greater resilience compared to exotic breeds. Vaccine development against parasites like *Haemonchus contortus* is also under investigation.

5.4 One Health and Climate-Smart Strategies

GI parasites have zoonotic potential, linking animal and human health. A One Health approach integrates veterinary, environmental, and public health strategies.

Climate-smart approaches involve predictive modeling and seasonal control programs to anticipate parasite outbreaks (Manave et al., 2025).

6. Future Perspectives

Future research should focus on:

- Development of novel anthelmintics
- Use of artificial intelligence in diagnosis
- Genomic studies of host–parasite interactions
- Sustainable, eco-friendly parasite control

Precision livestock farming and digital monitoring tools are expected to revolutionize parasite management.

Conclusion

Gastrointestinal parasites continue to pose a major challenge to ruminant health and productivity worldwide. Their epidemiology is influenced by a complex interplay of host, environmental, and management factors. Increasing prevalence and emerging drug resistance highlight the need for integrated and sustainable control strategies. Adoption of modern diagnostic tools, improved management practices, and climate-aware interventions will be essential for effective parasite control in the future.

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