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Parasitic Gastroenteritis in Livestock: A Hidden Threat to Animal Health

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Parasitic gastroenteritis (PGE) is a major cause of reduced productivity and economic loss in livestock worldwide. It is caused by a wide range of gastrointestinal parasites, including nematodes, cestodes, trematodes, and protozoa, which impair digestion, nutrient absorption, and overall animal health. Young animals are particularly susceptible because of their immature immune systems, while poor nutrition, stress, pregnancy, and inadequate management further increase disease risk. Clinical manifestations include diarrhoea, anaemia, weight loss, poor growth, reduced milk production, decreased reproductive performance, and, in severe cases, mortality. Warm and humid climatic conditions, extensive grazing, and poor pasture management favour parasite transmission, and climate change is further expanding their distribution. Accurate diagnosis relies on faecal examination, faecal egg count estimation, coproculture, serological tests, and advanced molecular techniques such as PCR, qPCR, LAMP, and CRISPR-based assays. Although anthelmintics remain the cornerstone of treatment, the rapid emergence of anthelmintic resistance, particularly among gastrointestinal nematodes, poses a significant challenge to sustainable parasite control. Integrated parasite management, incorporating targeted selective treatment, rotational grazing, routine faecal egg count monitoring, improved nutrition, biological control, vaccination, and strategic deworming, offers an effective approach to reduce parasite burden while delaying resistance. Furthermore, the zoonotic potential of several gastrointestinal parasites highlights the importance of a One Health approach involving veterinarians, livestock owners, researchers, and public health professionals. Emerging technologies, including precision diagnostics, genomic surveillance, artificial intelligence, and climate-based parasite forecasting, are expected to strengthen future parasite control programmes and improve livestock productivity.

Introduction

Parasitic gastroenteritis (PGE) is one of the most important gastrointestinal diseases affecting livestock and companion animals worldwide. It is caused by gastrointestinal nematodes, cestodes, trematodes, and protozoa that damage the digestive tract, resulting in impaired nutrient absorption, blood and protein loss, diarrhoea, reduced growth, poor productivity, and, in severe cases, death (Taylor *et al*., 2024). Young animals such as calves, lambs, kids, piglets, foals, puppies, and kittens are particularly susceptible because of their immature immune systems, whereas stress, malnutrition, pregnancy, and concurrent diseases increase susceptibility in adults (Bowman, 2021).

Parasitic gastroenteritis is especially prevalent in tropical and subtropical regions where warm temperatures and high humidity favour the development and survival of infective stages. In India, extensive grazing systems and prolonged monsoon seasons facilitate continuous transmission and reinfection (Ghosh and Nagar, 2014). Climate change has further expanded the geographical distribution and transmission period of many gastrointestinal parasites (Rose *et al*., 2015).

The disease causes substantial economic losses through reduced feed efficiency, poor weight gain, decreased milk production, impaired reproduction, inferior wool quality, increased treatment costs, and mortality. Gastrointestinal nematodes alone account for billions of dollars in annual losses worldwide (Charlier *et al*., 2014). In addition, several gastrointestinal parasites, including *Toxocara canis, Ancylostoma caninum, Giardia duodenalis, Cryptosporidium parvum,* and *Echinostoma* spp., are zoonotic, highlighting the importance of a One Health approach (Robertson *et al*., 2014).

Recent advances such as PCR, qPCR, LAMP, and CRISPR-based diagnostics have improved the rapid and species-specific detection of parasites. However, increasing anthelmintic resistance among gastrointestinal nematodes has become a major challenge, emphasizing the need for integrated parasite management based on targeted treatment, pasture management, and routine faecal egg count monitoring (Roeber *et al*., 2017; Kaplan, 2020).

What is Parasitic Gastroenteritis?

Parasitic gastroenteritis is the inflammation and functional impairment of the stomach and intestines caused by gastrointestinal parasites. Disease severity depends on parasite species, infection intensity, host age, immune status, nutrition, environmental conditions, and management practices (Taylor *et al*., 2024). Most gastrointestinal nematodes have direct life cycles, whereas cestodes and trematodes require intermediate hosts such as snails, mites, insects, or fleas, influencing their epidemiology (Bowman, 2021).

Major Gastrointestinal Parasites

Gastrointestinal parasites are broadly classified into four groups.

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Trematodes (Flukes)

Important intestinal flukes include *Paramphistomum cervi, Gastrothylax crumenifer, Echinostoma* spp., and *Artyfechinostomum sufrartyfex*. Immature paramphistomes cause severe enteritis, profuse diarrhoea, dehydration, and mortality in young ruminants, whereas intestinal echinostomes produce mucosal ulceration, malabsorption, chronic diarrhoea, and weight loss in dogs, pigs, and occasionally humans (Soulsby, 1982; Taylor *et al*., 2024).

Cestodes (Tapeworms)

Important tapeworms include *Moniezia expansa* and *M. benedeni* in ruminants, *Anoplocephala perfoliata* in horses, *Dipylidium caninum* in dogs, and *Taenia* spp. in dogs and cats. Although generally less pathogenic than nematodes, heavy infections may cause diarrhoea, poor growth, intestinal irritation, and occasionally intestinal obstruction. These parasites require intermediate hosts such as oribatid mites, fleas, or rodents for transmission (Taylor *et al*., 2024; Nielsen *et al*., 2018).

Nematodes (Roundworms)

Nematodes are the most important cause of parasitic gastroenteritis in domestic animals. In ruminants, important species include *Haemonchus contortus, Haemonchus placei, Ostertagia ostertagi, Teladorsagia circumcincta, Trichostrongylus* spp., *Cooperia* spp., *Bunostomum phlebotomum, Oesophagostomum radiatum,* and *Nematodirus* spp. Among these, *Haemonchus contortus* is the most pathogenic because it feeds on blood, causing severe anaemia, hypoproteinaemia, bottle jaw, weakness, and death in heavily infected sheep and goats (Kaplan, 2020).

In horses, important nematodes include *Strongylus vulgaris, Cyathostomins, Parascaris equorum,* and *Oxyuris equi*. Cyathostomins are particularly significant because encysted larvae may cause severe larval cyathostominosis (Nielsen *et al*., 2018).

Dogs and cats are commonly infected with *Ancylostoma caninum, Ancylostoma braziliense, Toxocara canis, Toxocara cati, Trichuris vulpis,* and *Uncinaria stenocephala*, resulting in diarrhoea, vomiting, anaemia, poor growth, and gastrointestinal disturbances (Bowman, 2021).

Protozoa

Major protozoan parasites include *Eimeria* spp., *Cystoisospora* spp., *Cryptosporidium parvum, Giardia duodenalis,* and *Balantidium coli*. These parasites invade intestinal epithelial cells, causing villous atrophy, malabsorption, dehydration, and profuse diarrhoea, particularly in young animals and intensive production systems.

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Epidemiology

The epidemiology of parasitic gastroenteritis (PGE) is determined by interactions among the parasite, host, and environment. Warm temperatures (20–30°C), high humidity, and adequate rainfall favour the development and survival of infective third-stage (L3) larvae on pasture, making transmission highest during the monsoon and post-monsoon seasons in tropical countries such as India (Taylor *et al*., 2024). Climate change is further expanding parasite distribution and prolonging transmission seasons (Rose *et al*., 2015).

Young animals, pregnant and lactating females, malnourished or immunosuppressed animals, and those under stress are more susceptible to infection. Periparturient relaxation of immunity in ewes and does increases egg shedding, leading to greater pasture contamination. Overstocking, continuous grazing, poor sanitation, mixed-age grazing, failure to quarantine new animals, and indiscriminate deworming increase infection risk, whereas rotational grazing, pasture resting, and targeted selective treatment help reduce parasite transmission.

Life Cycle of Gastrointestinal Parasites

Most gastrointestinal nematodes have a direct life cycle, in which eggs passed in faeces hatch into larvae that develop to infective third-stage (L3) larvae on pasture and are ingested during grazing. The prepatent period generally ranges from 2–4 weeks. In contrast, cestodes and trematodes have indirect life cycles requiring intermediate hosts such as oribatid mites (*Moniezia*), freshwater snails (*Paramphistomum*), fleas (*Dipylidium caninum*), and ants (*Dicrocoelium dendriticum*). Therefore, controlling intermediate hosts is an important component of parasite prevention (Taylor *et al*., 2024).

Pathogenesis

The severity of PGE depends on parasite species, infection intensity, host immunity, and nutritional status. Blood-feeding parasites such as *Haemonchus contortus* and hookworms cause severe anaemia and hypoproteinaemia through continuous blood loss; each *H. contortus* worm can consume approximately 0.05 mL of blood per day (Kaplan, 2020). Migrating larvae da11mage the intestinal mucosa, resulting in villous atrophy, crypt hyperplasia, reduced digestive enzyme activity, and impaired nutrient absorption. Inflammation increases vascular permeability and plasma leakage, leading to protein-losing enteropathy, oedema, and hypoproteinaemia. Host immune responses involving eosinophils, mast cells, cytokines, and goblet cell hyperplasia also contribute to intestinal dysfunction. Additionally, parasites alter gastrointestinal physiology by affecting acid secretion, motility, and digestion; for example, *Ostertagia ostertagi* destroys abomasal parietal cells, increasing abomasal pH and reducing protein digestion.

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Clinical Signs

Clinical manifestations vary with parasite species, infection intensity, and host immunity. Common signs include diarrhoea, weight loss, poor growth, reduced feed intake, rough hair coat, anaemia, weakness, and decreased productivity. Cattle often exhibit chronic diarrhoea, bottle jaw, pale mucous membranes, and reduced milk yield. Sheep and goats infected with *Haemonchus contortus* commonly develop severe anaemia, bottle jaw, exercise intolerance, and sudden death, with FAMACHA© scoring serving as a valuable tool for targeted treatment. Horses may present with recurrent colic, chronic diarrhoea, poor body condition, and larval cyathostominosis. In pigs, infection causes diarrhoea, poor feed conversion, and unthriftiness, whereas dogs and cats typically develop diarrhoea, vomiting, weight loss, poor growth, dehydration, and, in hookworm infections, haemorrhagic diarrhoea or melena.

Gross and Microscopic Lesions

Gross lesions include hyperaemia, oedema, thickening of abomasal folds, catarrhal enteritis, mucosal congestion, petechial haemorrhages, villous atrophy, intestinal nodules caused by *Oesophagostomum*, and occasionally hepatic necrosis or fibrosis associated with migrating trematodes. Microscopically, characteristic lesions include villous atrophy, crypt hyperplasia, goblet cell hyperplasia, eosinophilic and lymphoplasmacytic infiltration, mast cell proliferation, mucosal ulceration, submucosal oedema, haemorrhage, and necrosis. These pathological changes impair digestion and nutrient absorption, resulting in poor animal performance and productivity

Laboratory Diagnosis

Diagnosis of parasitic gastroenteritis (PGE) is based on clinical signs, laboratory investigations, and advanced molecular techniques. Clinical features such as diarrhoea, weight loss, anaemia, poor body condition, and bottle jaw require laboratory confirmation (Taylor *et al*., 2024). Faecal examination remains the cornerstone of diagnosis, with flotation and direct smear techniques used for nematodes, cestodes, and protozoa, while sedimentation is preferred for trematode eggs. The McMaster technique estimates faecal egg counts (EPG) to assess parasite burden and treatment efficacy, and coproculture identifies infective third-stage (L3) larvae (Zajac & Conboy, 2021). Haematological findings commonly include anaemia, eosinophilia, hypoproteinaemia, and hypoalbuminaemia, particularly in *Haemonchus contortus* infections (Kaplan, 2020). ELISA is useful for herd-level surveillance, whereas molecular methods such as PCR, qPCR, LAMP, and CRISPR-based assays provide rapid,

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highly sensitive, and species-specific detection of mixed and subclinical infections (Roeber *et al*., 2017).

Treatment

Treatment should be based on accurate parasite identification and infection severity. Common anthelmintics include benzimidazoles (albendazole, fenbendazole), levamisole, macrocyclic lactones (ivermectin, moxidectin), salicylanilides (closantel, rafoxanide), and monepantel (Taylor *et al*., 2024). Protozoal infections such as coccidiosis and giardiasis are treated with toltrazuril, diclazuril, sulfonamides, or fenbendazole (Bowman, 2021). Supportive therapy comprising fluid and electrolyte replacement, nutritional supplementation, probiotics, vitamin-mineral therapy, and blood transfusion in severe anaemia improves recovery.

Anthelmintic Resistance and FECRT

Anthelmintic resistance (AR), defined as the inherited ability of parasites to survive recommended drug doses, has become a major obstacle to effective parasite control, particularly in *Haemonchus contortus* (Kaplan, 2020). Resistance is mainly driven by indiscriminate deworming, underdosing, repeated use of the same drug class, and inadequate refugia management (Kotze & Prichard, 2016). The Faecal Egg Count Reduction Test (FECRT) is the standard field method for detecting resistance. A faecal egg count reduction of ≥95% indicates effective treatment, 90–95% suggests suspected resistance, and <90% confirms resistance (Coles *et al*., 1992; Kaplan, 2020).

Integrated Parasite Management

Sustainable parasite control relies on Integrated Parasite Management (IPM) rather than routine blanket deworming. Key components include strategic and targeted selective treatment (TST), rotational grazing, pasture hygiene, quarantine of newly introduced animals, and routine faecal egg count monitoring (Charlier *et al*., 2014). Selection of animals for treatment based on FAMACHA© scores, body condition, growth performance, and faecal egg counts minimizes unnecessary anthelmintic use and delays the development of resistance (Kaplan, 2020).

Nutritional Strategies

Adequate nutrition strengthens host immunity and resilience against gastrointestinal parasites. Diets rich in protein, energy, and essential trace minerals such as copper, cobalt, selenium, and zinc improve resistance, reduce worm burdens, and enhance productivity, particularly in sheep and goats infected with *Haemonchus contortus* (Coop & Kyriazakis, 2001).

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Vaccines and Biological Control

Vaccination and biological control offer promising complementary approaches for sustainable parasite management. Barbervax®, developed against *Haemonchus contortus*, effectively reduces worm burdens and pasture contamination in sheep, while vaccines against other gastrointestinal nematodes are under development (Nisbet *et al*., 2016). Biological control using nematophagous fungi such as *Duddingtonia flagrans* and the use of tannin-rich forages or phytotherapeutic compounds can further reduce parasite transmission and dependence on synthetic anthelmintics (Hoste *et al*., 2015).

One Health Significance

Several gastrointestinal parasites, including *Toxocara canis*, *Ancylostoma* spp., *Giardia duodenalis*, *Cryptosporidium parvum*, and *Echinostoma* spp., are zoonotic and can cause visceral or ocular larva migrans, cutaneous larva migrans, and enteric disease in humans. Regular deworming, improved sanitation, safe water, meat inspection, and public awareness are essential to reduce zoonotic transmission (Robertson *et al*., 2014).

Future Perspectives

Future control of PGE will increasingly depend on precision diagnostics and sustainable parasite management. Emerging technologies such as CRISPR-based point-of-care diagnostics, artificial intelligence-assisted faecal egg detection, genomic surveillance of drug resistance, climate-based parasite forecasting, recombinant vaccines, and precision livestock farming are expected to improve disease control and reduce economic losses (Roeber *et al*., 2017; Taylor *et al*., 2024).

Conclusion

Parasitic gastroenteritis remains a major challenge to livestock productivity and companion animal health worldwide. Early diagnosis, strategic anthelmintic use, integrated parasite management, improved nutrition, and emerging vaccines and biological control methods are essential for sustainable parasite control. Combating anthelmintic resistance requires routine parasite monitoring, targeted treatment, and adoption of a One Health approach involving veterinarians, farmers, researchers, and public health professionals (Taylor *et al*., 2024; Kaplan, 2020).

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