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Epidemiology Of Gastrointestinal Parasites In Livestock Of Cooch Behar District, India

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Abstract

Livestock rearing, particularly cattle, sheep, and goats, forms a significant backbone of the rural economy in India. Gastrointestinal (GI) parasitic infections pose a substantial economic burden due to reduced productivity, compromised health, and increased mortality in livestock. While studies exist on the prevalence of GI parasites in these animals across India, information from the Cooch Behar district of North Bengal is lacking. This study aimed to investigate the prevalence and burden of GI parasites in cattle, goats, and sheep from Cooch Behar district. A total of 412 fecal samples (148 cattle, 124 goats, and 140 sheep) were collected from January to December 2019 and examined using standard parasitological techniques. The overall prevalence of GI parasites was alarmingly high: 72.97% in cattle, 76.61% in goats, and 67.85% in sheep. No significant difference was observed in prevalence between the three livestock species ($p > 0.05$). However, a significant seasonal effect ($p < 0.05$) was identified, with the highest prevalence and intensity of infection observed during the rainy season, followed by summer and winter. Eimeria spp. (coccidia) and *Strongyloides* spp. (nematodes) were the most prevalent parasites identified, followed by *Trichostrongylus* spp., *Fasciola spp*., *Bunostomum* spp., *Nematodirus* spp., *Moniezia* spp., *Paramphistomum* spp., *Oxyuris* spp., and *Trichuris* spp. These findings highlight the critical need for strategic deworming programs, improved hygiene practices, and further research on the impact of these parasites on livestock health and productivity in the Cooch Behar district.

Keywords: Gastrointestinal parasites, Cattle, Goats, Sheep, Cooch Behar, Prevalence, Seasonality.

1. Introduction

Livestock rearing, particularly cattle, sheep, and goats, forms the backbone of rural economies across South Asia, contributing significantly to food security, income generation, and rural livelihoods (Raza et al., 2007; Singh et al., 2015). However, the health and productivity of these animals are often compromised by various parasitic infections, with gastrointestinal (GI) parasites posing a major economic and public health concern (Urquhart et al., 1996). GI parasites can cause substantial economic losses estimated in billions of dollars globally due to reduced milk yield, meat production, wool quality, and increased treatment costs associated with morbidity and mortality in heavily parasitized animals (Fikru et al., 2006).

Ruminant livestock, including cattle, sheep, and goats, are particularly susceptible to a diverse range of GI nematodes, cestodes, trematodes, and protozoa (Taylor et al., 2007). These parasites have complex life cycles, often involving intermediate hosts or environmental stages, leading to widespread distribution and persistence in grazing pastures (Urquhart et al., 1996). The prevalence and intensity of GI parasite infections can vary considerably depending on several factors, including geographical location, climatic conditions, animal management practices, and host immune status (Yadav & Garg, 2012).

Cooch Behar district, situated in the foothills of the Eastern Indo-Himalayas in North Bengal, India, is known for its diverse livestock population. However, information on the prevalence and burden of GI parasites in cattle, goats, and sheep from this region is scarce. This lack of knowledge hinders the development of effective control strategies to safeguard animal health and optimize livestock production in the region. Studies from other parts of India have reported varying prevalence rates of GI parasites in livestock. These studies highlight the widespread problem of GI parasites in livestock across India and the need for region-specific investigations (Raza et al., 2007; Singh et al., 2015).

Understanding the prevalence and species composition of GI parasites in Cooch Behar district is crucial for establishing effective parasite control programs. This study aimed to investigate the prevalence and intensity of GI parasites in cattle, goats, and sheep from Cooch Behar district. The findings will contribute valuable insights for designing targeted parasite control programs and promoting best practices in livestock management within the region.

2. Materials and Methods

2.2. Study Area

The study was conducted in the Cooch Behar district of North Bengal, India. This region experiences a tropical monsoon climate with distinct dry and wet seasons and is located between 26.22º N to 26.58º N latitude and 89.45º E to 89.83º E longitude. This is a descriptive cross-sectional study comprising 412 livestock (cattle, Goat, and Sheep) from January to December 2018. The study area was divided into four subdivisions of Cooch Behar district taking into account the altitudinal gradients and landscapes. The subdivisions were A: Tufanganj, B: Cooch Behar Sadar, C: Dinhata, D: Mathabhanga (Fig. 1).

2.3. Sample Size Determination

A simple random sampling method was employed to select study animals. Assuming a 50% expected prevalence, a desired absolute precision of 5%, and a 95% confidence interval, the sample size was calculated using the formula provided by Thrusfield et al. (2007).:

$N = Z^2 \times P_{exp} (1 - P_{exp}) / d^2$

where N is the required sample size, d is the desired absolute precision (0.05), Z^2 is the statistic for the level of confidence (1.96), and P_{exp} is the anticipated prevalence. Based on this formula, a minimum sample size of 384 animals was determined. However, to enhance the study's accuracy, a total of 412 animals (148 cattle, 124 goats and 140 sheep).

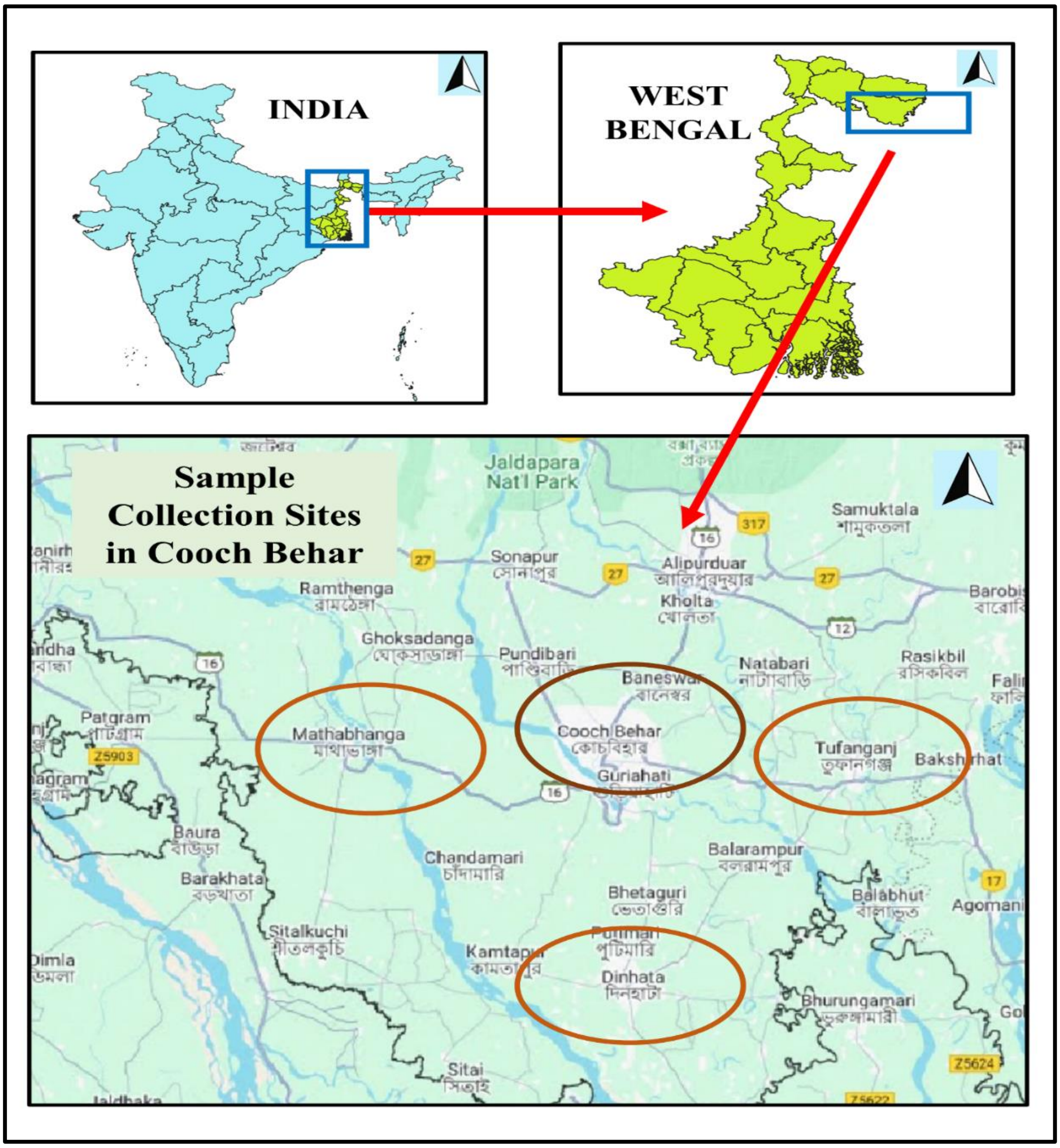

Figure 1: Map of the sample collection sites in Cooch Behar district, West Bengal, India.

2.4. Faecal Sample Collection and Coprological Analysis

412 fresh fecal samples from cattle, goats, and sheep raised under semi-intensive conditions were collected for the investigation of parasite infection. The fecal samples (148 from cattle, 124 from goats, and 140 from sheep) were collected early morning from the ground immediately after defecation during January To December 2019. To preserve the samples for further analysis, around 20-25 grams of each sample were placed in separate, sealed plastic bags containing a 10% formalin solution. Upon collection, the samples underwent a detailed routine parasitological analysis to detect the presence of parasite eggs. This analysis employed three techniques: direct smear examination, standard sedimentation, and flotation. Identification of parasite eggs relied on comparing their morphology (shape) and morphometry (size) to followed by Soulsby (1982).

2.4.1. Direct method

A small amount of feces was mixed with a drop of water on a clean, grease-free slide until a uniform suspension was achieved. The mixture was then strained to remove any large particles or fibers before being covered with a coverslip, ensuring no air bubbles were trapped. Finally, the prepared slide was examined under a phase-contrast microscope (Bowman,1999).

2.4.2. Sedimentation Method

Approximately one gram of feces was mixed thoroughly with a small amount of water in a glass mortar. The resulting suspension was then strained to eliminate any large particles or debris. The strained liquid was transferred to a centrifuge tube, filling it to about an inch from the top. The tube was then spun in a centrifuge at 1000 to 1500 revolutions per minute (rpm) for 2-3 minutes. After centrifugation, the clear liquid on top (supernatant) was discarded. A drop of the remaining sediment (concentrated fecal material) was then placed on a microscope slide and examined under a phase-contrast microscope with a coverslip placed on top. The presence of parasite eggs was determined based on their unique shapes and sizes (morphological characteristics), as described by Bowman (1999).

2.4.3. Flotation Method

A fecal flotation technique was employed to identify parasite eggs in stool samples. Around two grams of feces were first mixed thoroughly in a glass mortar with a small amount of a saturated flotation solution. This solution could be made from magnesium sulfate, zinc sulfate, or even sugar. After mixing well, the suspension was strained to remove any large debris that might interfere with observation. The strained liquid was then transferred to a centrifuge tube and spun at 1500 rpm for 2-3 minutes. Following centrifugation, the top layer of the liquid was carefully collected and examined under a phase-contrast microscope with a coverslip placed on top. By analyzing the morphological characteristics (unique shapes and sizes) of any objects present in this layer, researchers could identify the presence of parasite eggs, as described by Bowman (1999).

3. Results

3.1. Overall Prevalence of infection

This study thoroughly examined the prevalence and intensity of gastrointestinal (GI) parasites in livestock from the Cooch Behar district of North Bengal, India, encompassing cattle, goats, and sheep. A comprehensive total of 412 fecal samples were meticulously collected, including 148 from cattle, 124 from goats, and 140 from sheep. Employing established parasitological techniques such as flotation and sedimentation, a diverse array of GI parasites was identified. Alarmingly, the analysis revealed a high overall prevalence of GI parasites across all three livestock species: 72.97% in cattle (108 out of 148), 76.61% in goats (95 out of 124), and 67.85% in sheep (95 out of 140) (Table. 1). Statistical analysis indicated no significant difference ($p > 0.05$) in the prevalence of GI parasites among cattle, goats, and sheep, underscoring that these species are equally susceptible to parasitic infections in Cooch Behar district. These findings highlight the pervasive challenge posed by GI parasites to livestock health and productivity, necessitating urgent attention and intervention to mitigate the detrimental impacts on the agricultural economy in the region.

Table 1: Overall prevalence of infection with GI parasites in livestock

Livestock	Number of faecal samples examined	Number found infected	Prevalence of infection (%)
Cattle (*Bos taurus*)	148	108	72.97
Goat (*Capra hircus*)	124	95	76.61
Sheep (*Ovis aries*)	140	95	67.86
Total sample	412	298	72.33

3.2. Prevalence of infection with GI parasites

A comprehensive parasitological examination of faecal samples from livestock revealed a significant burden of gastrointestinal (GI) parasites, with a rich diversity of species identified. *Eimeria* spp. was the most prevalent parasite (75.72% across all livestock species), followed by *Strongyloides* spp. (nematode) at 57.03%. Other identified nematodes included *Trichostrongylus* spp. (51.45%), *Bunostomum* spp. (19.41%), *Nematodirus* spp. (13.83%), and lower prevalences of Oxyuris spp. and *Trichuris* spp. (<10%). *Moniezia* spp. (cestode) was present in 10.92% of animals, while Fasciola spp. (trematode) and *Paramphistomum* spp. (trematode) exhibited prevalences of 42.23% and 35.19%, respectively (Figure 2). These findings highlight the significant burden of GI parasites in the studied livestock population.

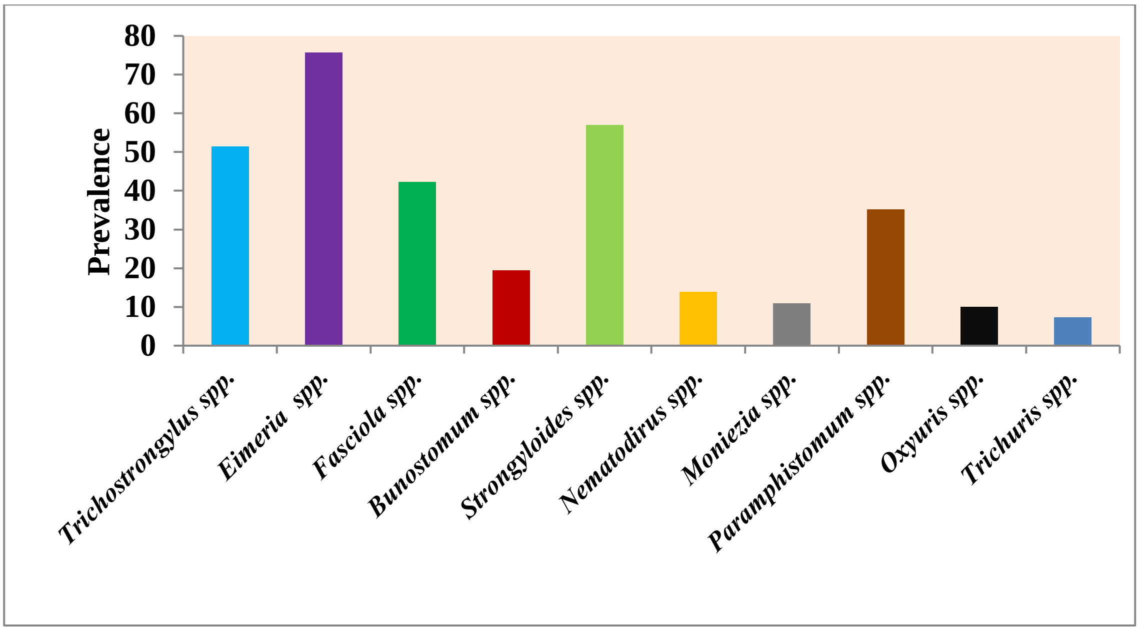

Figure 2: Prevalence of different GI parasites in livestock in Cooch Behar district.

3.3. Seasonal Variation in Prevalence and Intensity

The study investigated the seasonal prevalence of gastrointestinal (GI) parasites in cattle, goats, and sheep from Cooch Behar district of North Bengal, India, revealing significant seasonal variations. The overall prevalence of GI parasites was highest during summer at 77.30%, followed by monsoon at 70.68%, and winter at 64.89%. In cattle, the highest prevalence was observed in summer (81.54%), with a decline in monsoon (69.57%) and winter (62.16%). Similarly, goats exhibited the highest prevalence in summer (82.14%), with slightly lower rates in monsoon (76.19%) and winter (65.38%). Sheep showed a comparable pattern with a peak in summer (76.56%), followed by monsoon (66.67%), and a significant drop in winter (51.61%) (figure 3). These findings underscore the substantial seasonal influence on GI parasite prevalence, particularly during summer, necessitating targeted control measures to enhance livestock health and productivity year-round.

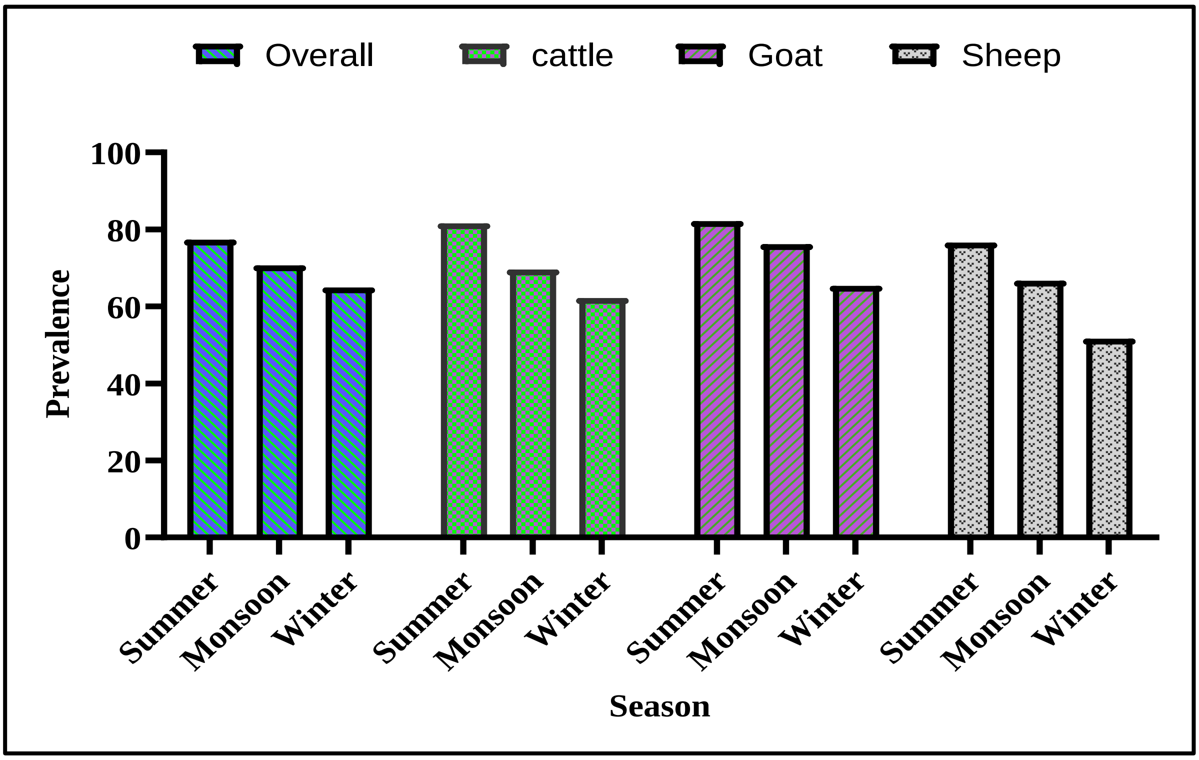

Figure 3: Seasonal prevalence of GI parasites in livestock in Cooch Behar district.

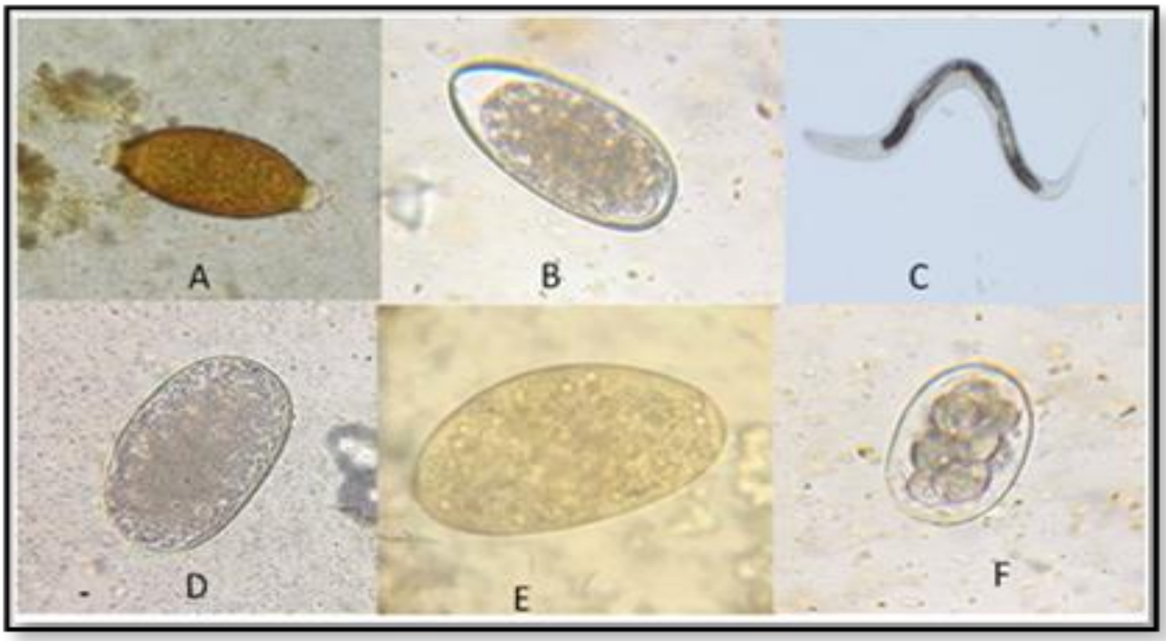

Fig: Microscopic view (400X) of different types eggs A-*Trichuris* sp., B-*Trichostrongylus* sp.,C-*Bunostomum* sp., E-*Fasciola* sp., D-*Ascaris* sp., unfertile decorticated egg ,F- Hookworm egg

4. Discussion

The high prevalence of gastrointestinal (GI) parasites in livestock from the Cooch Behar district underscores a critical challenge to animal health and productivity in this region. Our study found an overall GI parasite prevalence of 72.33% across cattle, goats, and sheep, with the highest rates observed in goats (76.61%) and the lowest in sheep (67.85%). These findings align with previous studies conducted in different regions of India, which also reported high rates of GI parasite infections in livestock, emphasizing the widespread nature of this issue (Raza et al., 2007; Singh et al., 2015).

Seasonal variation plays a significant role in the prevalence and intensity of GI parasites, with the highest infection rates recorded during the summer (77.30%), followed by the monsoon (70.68%), and the lowest in winter (64.89%). This pattern can be attributed to the climatic conditions favorable for parasite development and survival, such as higher temperatures and humidity during summer and monsoon seasons, which promote the growth and transmission of infective stages of parasites (Urquhart et al., 1996; Fikru et al., 2006). Similar seasonal trends have been reported in other studies, highlighting the increased risk of GI parasite infections during warmer and wetter periods (Yadav & Garg, 2012).

The identification of a diverse range of GI parasites, including *Eimeria* spp., *Strongyloides* spp., *Trichostrongylus* spp., *Fasciola* spp., *Bunostomum* spp., *Nematodirus* spp., *Moniezia* spp., *Paramphistomum* spp., *Oxyuris* spp., and *Trichuris* spp., indicates a complex parasitic burden in the studied livestock population. *Eimeria* spp. (coccidia) and *Strongyloides* spp. (nematodes) were the most prevalent parasites, reflecting their robust life cycles and adaptability to varied environmental conditions (Taylor et al., 2007). The high prevalence of these parasites necessitates the implementation of strategic deworming programs, focusing on the most affected seasons to reduce the parasitic load and mitigate the adverse effects on livestock health and productivity (Vercruysse et al., 2018).

Effective control measures should include regular fecal examinations to monitor parasite burdens, strategic use of anthelmintics, and improved pasture management practices to minimize exposure to infective stages. Additionally, enhancing the awareness and knowledge of livestock farmers regarding the importance of parasite control and the implementation of integrated parasite management strategies is crucial (Sutherland & Leathwick, 2011). Further research is needed to evaluate the efficacy of different anthelmintic treatments and to explore alternative control methods, such as biological control agents and vaccination, to ensure sustainable livestock production in the Cooch Behar district and similar regions.

Conclusion:

The high prevalence and seasonal variation of GI parasites in livestock from Cooch Behar district highlight the critical need for implementing effective control strategies. Considering the potential economic losses associated with these parasites, a multi-pronged approach is recommended. This includes further research to understand the drivers of parasite transmission, the development of evidence-based IPM programs, and educating farmers on best practices for parasite control. By implementing these strategies, the health and productivity of livestock in the Cooch Behar district and beyond can be significantly improved, contributing to the livelihoods of farmers and the overall sustainability of livestock production systems.

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