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Original Article

Prevalence of Gastrointestinal Tract Parasites in Dairy Cattle in Tehsil Gagra District Buner Khyber Pakhtunkhwa, Pakistan

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ABSTRACT

Background: Gastrointestinal (GI) parasites pose a significant threat to dairy cattle health, affecting both animal welfare and agricultural productivity. In regions like Tehsil Gagra, District Buner, Khyber Pakhtunkhwa, Pakistan, where dairy farming is a crucial part of the economy, understanding the prevalence and types of these parasites is essential. The potential zoonotic impact of these parasites also raises concerns for human healthcare, emphasizing the importance of a One Health approach.

Objective: This study aimed to determine the prevalence and types of gastrointestinal parasites in dairy cattle in Tehsil Gagra, District Buner, and to understand their implications for animal health, agricultural practices, and potential zoonotic risks to human health.

Methods: A comprehensive analysis was conducted from July 2021 to July 2022. A total of 150 fecal samples from dairy cattle were collected and examined at the Veterinary Research and Disease Investigation Center, District Swat, and the Department of Zoology, University of Buner. The samples were tested using direct smear, sedimentation, and sugar flotation methods. The study also considered environmental factors and seasonal variations in its analysis.

Results: Of the 150 samples examined, 99 (66%) were positive for gastrointestinal parasites. Nematodes were the most prevalent (51.33%), followed by Protozoa (12%), Trematodes (2%), and Cestodes (0.67%). The most common parasitic species identified were Trichostrongylus (24.67%), Ostertagia ostertagi (22.67%), and Eimeria bovis (8%). Area-wise, Rega showed the highest prevalence at 80%, while Gagra recorded 46.67%.

Conclusion: The study revealed a high prevalence of GI parasites in dairy cattle in Tehsil Gagra, District Buner, emphasizing the need for improved veterinary care and farm management practices. The results highlight the importance of regular parasite control measures and suggest potential zoonotic risks, underscoring the necessity for integrated animal and human health approaches.

Keywords: Gastrointestinal Parasites, Dairy Cattle, Nematodes, Protozoa, Zoonotic Diseases, One Health, Veterinary Parasitology, Public Health, Agricultural Productivity, Pakistan.

INTRODUCTION

Dairy cattle, integral to human societies for millennia, have provided essential resources such as milk, meat, and leather, shaping economies and livelihoods. Historically, dairy cattle were a cornerstone of sustenance, with their products being indispensable in daily life (1). Currently, they remain pivotal in various industries, contributing significantly to income generation (2). Their milk is utilized not only as a nutritional staple but also in the production of yogurt, cheese, and a variety of bakery items. Leather, a byproduct, finds extensive use in manufacturing goods like shoes and jackets. Furthermore, cattle waste is increasingly harnessed for biogas production, exemplifying sustainable resource utilization (2, 3).

Journal of Health and Rehabilitation Research 2791-156X JHRR

Globally, livestock represents approximately 40% of agricultural output, underpinning the food and nutrition security of around 1.3 billion individuals (4). In Pakistan, an agrarian economy, the agricultural sector is vital, second only to the textile industry in economic contribution (5). Within this sector, livestock plays a crucial role, comprising about 60.6% of agricultural activities and contributing around 11.7% to the national GDP as of 2019-20. The gross value of livestock during this period was estimated at 1,466 billion PKR. Predominantly rural populations depend on livestock as a primary occupation and income source (6).

However, this sector faces significant challenges due to gastrointestinal tract (GIT) parasitic infections, which severely hamper productivity. GIT parasites, including protozoa and helminths such as nematodes, trematodes, and cestodes, lead to conditions like anemia, diarrhea, weight loss, and overall economic losses in cattle herds (7). These infections affect cattle worldwide, particularly in tropical and subtropical regions, where they severely impact livestock health and production. While not always fatal, these parasitic infections compromise growth rates, nutritional status, and by-product quality of dairy cattle, increasing their susceptibility to other infections (8).

GIT parasites primarily reside in the digestive tract, causing anemia and diarrhea. The resultant health and productivity losses include weight loss, poor reproductive function, digestive disorders, and chronic weakness. These infections pose significant economic burdens on the livestock industry (9). However, the magnitude of the problem is often underestimated due to the predominantly subclinical or chronic nature of these infections (10).

Significance for Human Healthcare

The study of GIT parasitism in dairy cattle extends beyond veterinary concerns, holding substantial implications for human healthcare. These parasites, through their impact on livestock health and productivity, indirectly affect human nutrition and economic stability, particularly in agrarian communities (11). Furthermore, the study of such parasitic infections contributes to a broader understanding of zoonotic diseases, their transmission dynamics, and control strategies, which are vital in the context of emerging infectious diseases and global health security (12). Thus, addressing GIT parasitism in dairy cattle is not only crucial for animal health and agricultural productivity but also for advancing human health outcomes and ensuring food security in regions dependent on livestock-based economies (13).

MATERIAL AND METHODS

In a comprehensive study conducted in Tehsil Gagra, District Buner, Khyber Pakhtunkhwa, Pakistan, researchers focused on the prevalence of gastrointestinal tract parasites in dairy cattle. Buner, situated within the Malakand division, lies in a geographical expanse stretching from 34-11° to 34-43° North Latitude and from 72-13° to 72-45° East Longitude, encompassing an area of 1865 km². With a population of approximately 897,319 as per the 2017 census, this region is significant in terms of agricultural and livestock activities (14).

The research methodology involved meticulous sample collection and laboratory analysis. Fresh fecal samples from dairy cattle were collected directly from the rectum using plastic gloves and placed in plastic bottles containing 10% formalin solution. These samples were promptly transported and analyzed on the same day at the Parasitology section of the Veterinary Research and Disease Investigation Center in Balogram, District Swat, and at the Department of Zoology, University of Buner. The objective was to detect cysts or eggs of gastrointestinal parasites.

The laboratory analysis comprised several techniques using a variety of tools. The direct smear method involved spreading a thin film of feces on a glass slide, followed by the addition of a few drops of saline, and then examining it under a microscope. The sugar flotation technique was used to identify eggs of nematodes and cestodes. In this method, a fecal sample was mixed with a sugar solution, lightly grinded, sieved, and then centrifuged. A cover slip placed on the top of the tube would collect the floating eggs for examination under a microscope. The sugar solution was prepared by dissolving ground sugar in distilled water and adding formalin. The sedimentation method, used primarily for detecting trematode eggs, involved mixing feces with water, filtering, and allowing it to sediment. The clear supernatant was then removed, and the sediment was examined under a microscope with a drop of methylene blue.

For the identification of the parasites, specific identification keys were used. The data obtained from the study was analyzed using GraphPad version 5 software. The prevalence of various GIT parasitic species was calculated by the formula: Prevalence (%) = (Number of positive samples / Total number of samples examined) × 100.

RESULTS

In the conducted study, the prevalence of gastrointestinal parasites in dairy cattle in Tehsil Gagra, District Buner, Khyber Pakhtunkhwa, Pakistan, was extensively analyzed and the findings are presented across various tables.

Journal of Health and Rehabilitation Research 2791-156X JHRR

The overall prevalence of gastrointestinal parasites was found to be quite high. Out of the 150 samples examined, 99 tested positive, indicating an overall prevalence of 66% (Table 1). A closer look at the types of parasites (Table 2) revealed that Nematodes were the most prevalent, found in 77 samples, accounting for 51.33%. Protozoan parasites were detected in 18 samples, making up 12% of the findings. Trematodes and Cestodes were less frequent, observed in 3 samples (2%) and 1 sample (0.67%) respectively. Interestingly, 51 samples, representing 34% of the total, showed no infection.

A detailed species-level analysis (Table 3) highlighted that Trichostrongylus was the most commonly identified parasite, infecting 24.67% of the cattle (37 out of 150). Ostertagia ostertagi was close behind, affecting 22.67% (34 out of 150). Other species such as Eimeria bovis, Eimeria auburnensis, Fasciola hepatica, Haemonchus contortus, Strongyloides papillosus, Trichuris ovis, Moniezia expensa, Eimeria zurnii, and Cryptosporidium were also identified, each with varying prevalence rates, all under 10%.

Table 1 Overall Prevalence of Gastrointestinal Parasites in Dairy Cattle

Total Samples Examined	Total Positive	Overall Prevalence (%)
150	99	66

Table 2 Types of Parasites Observed

S.No.	Name of Parasite	Samples	Percentage (%)
1	Nematodes	77	51.33
2	Protozoan	18	12
3	Trematodes	3	2
4	Cestodes	1	0.67
5	Uninfected	51	34

Table 3 Types of Gastrointestinal Parasitic Species Observed

S.No.	Name of Parasite	No. of Cattle Infected	Percentage (%)
1	Trichostrongylus	37	24.67
2	Ostertagia ostertagi	34	22.67
3	Eimeria bovis	12	8
4	Eimeria auburnensis	4	2.67
5	Fasciola hepatica	3	2
6	Haemonchus contortus	3	2
7	Strongyloides papillosus	3	2
8	Trichuris ovis	2	1.33
9	Moniezia expensa	1	0.67
10	Eimeria zurnii	1	0.67
11	Cryptosporidium	1	0.67

Table 4 Area Wise Prevalence

S.No.	Places	Positive	Total Samples	Percentage (%)
1	Rega	24	30	80
2	Gagra	14	30	46.67
3	Shalbandai	20	30	66.67
4	Dewana Baba	22	30	73.33
5	Cheena	19	30	63.33

Journal of Health and Rehabilitation Research 2791-156X JHRR

Table 5 Prevalence of Gastrointestinal Parasites in Village Rega

S.No.	Name of Parasite	Positive Samples	Percentage (%)
1	Ostertagia ostertagi	8	26.67
2	Trichostrongylus	12	40
3	Strongyloides papillosus	1	3.33
4	Haemonchus contortus	3	10

Table 6 Prevalence of Gastrointestinal Parasites in Village Gagra

S.No.	Name of Parasite	Positive Samples	Percentage (%)
1	Trichostrongylus	5	16.67
2	Ostertagia ostertagi	4	13.33
3	Eimeria auburnensis	2	6.67
4	Eimeria bovis	2	6.67
5	Eimeria zurnii	1	3.33
6	Trichuris ovis	2	6.67

Table 7 Prevalence of Gastrointestinal Parasites in Village Dewana Baba

S.No.	Name of Parasite	Positive Samples	Percentage (%)
1	Trichostrongylus	9	30
2	Ostertagia ostertagi	7	23.33
3	Strongyloides	2	6.67
4	Cryptosporidam	1	3.33
5	Eimeria bovis	3	10

Table 8 Prevalence of Gastrointestinal Parasites in Village Shalbandai

S.No.	Name of Parasite	Positive Samples	Percentage (%)
1	Ostertagia ostertagi	9	30
2	Trichostrongylus	6	20
3	Eimera Bovis	3	10
4	Eimeria auburnensis	2	6.67

Table 9 Prevalence of Gastrointestinal Parasites in Village Cheena

S.No.	Name of Parasite	Positive Samples	Percentage (%)
1	Ostertagia ostertagi	6	20
2	Trichostrogylus	5	16.67
3	Eimeria bovis	4	13.33
4	Faciola hepatica	3	10
5	Moneizia expensa	1	3.33

Table 10 Comparison of Methods Used for the Detection of Parasites

S.No.	Methods	Positive	Negative	Percentage (%)
1	Sugar Flotation Method	85	65	56.67
2	Direct Smear Method	20	130	13.33
3	Sedimentation Method	12	138	8

The area-wise prevalence of these parasites also varied significantly (Table 4). In Rega, 80% of the samples were positive (24 out of 30), while Gagra reported a lower prevalence of 46.67% (14 out of 30). Shalbandai, Dewana Baba, and Cheena showed prevalence rates of 66.67% (20 out of 30), 73.33% (22 out of 30), and 63.33% (19 out of 30), respectively.

Further dissection of the data at the village level provided more insights. In Village Rega (Table 5), Ostertagia ostertagi and Trichostrongylus were particularly prevalent, detected in 26.67% and 40% of the samples, respectively. Village Gagra (Table 6) had a prevalence of Trichostrongylus at 16.67% and Ostertagia ostertagi at 13.33%. In Village Dewana Baba (Table 7), these parasites were found in 30% and 23.33% of the samples, respectively. Similar trends were observed in Shalbandai (Table 8) and Cheena (Table 9), with varying prevalence rates of the identified parasites.

Lastly, the efficacy of different diagnostic methods was compared (Table 10). The Sugar Flotation Method emerged as the most effective, with a 56.67% detection rate (85 positive out of 150 samples). The Direct Smear Method detected parasites in 13.33% of the samples (20 out of 150), and the Sedimentation Method identified parasites in 8% of the samples (12 out of 150).

These findings, rich in numerical values and cross-referenced with corresponding tables, provide a comprehensive overview of the prevalence and types of gastrointestinal parasites in dairy cattle in this specific region of Pakistan.

DISCUSSION

The present study, conducted in Tehsil Gagra, District Buner, from July 2021 to July 2022, offers a critical insight into the prevalence and types of gastrointestinal tract parasites in dairy cattle, a key aspect of veterinary parasitology with implications for both animal health and public health (15).

The study's finding that 66% of the dairy cattle fecal samples were positive for gastrointestinal parasites is a significant observation. This high prevalence rate is comparable to findings in other regions, suggesting a widespread issue in dairy cattle management and health. The predominance of gastrointestinal nematodes, affecting 51.33% of the sampled population, is particularly noteworthy. This aligns with studies from other parts of Pakistan (16, 17), indicating a consistent pattern of nematode infestation across different geographic and climatic conditions.

Among the various parasites identified, the most common was Trichostrongylus, with a prevalence of 24%. This finding is nearly parallel to the prevalence rate reported in District Charsaddah (18). Trichostrongylus species, known for their resilience in cooler climates, raise concerns about their survival and propagation under diverse environmental conditions. The study period's cold and dry weather could have contributed to the higher prevalence of this parasite, corroborating the hypothesis that Trichostrongylus thrives in such conditions (19, 20).

Gastrointestinal nematodes are not just a health concern for the cattle but also impact their productivity. Infestations can lead to malnutrition, decreased milk production, and overall reduced growth rates, thereby affecting the economic viability of cattle farming. The results of this study suggest a need for strategic grazing management, possibly including controlled grazing times and pre-grazing mowing of pastures, to reduce nematode exposure. However, the effectiveness of these interventions at a farm level warrants further investigation (21).

The presence of parasites with zoonotic potential, such as Cryptosporidium, is particularly concerning. These parasites can transmit from animals to humans, leading to gastrointestinal infections in humans. This cross-species transmission highlights the interconnectedness of human and animal health and underscores the importance of adopting a One Health approach. This approach recognizes that the health of people is closely connected to the health of animals and our shared environment. It emphasizes the need for multidisciplinary efforts to monitor and control zoonotic diseases.

Environmental conditions and seasonal changes are crucial factors affecting the prevalence and intensity of parasitic infections. The cold and dry conditions during the sample collection period could have influenced the lifecycle stages of various parasites, particularly those like Trichostrongylus, which have demonstrated resilience under such conditions. Understanding these environmental influences is vital for developing targeted and effective control strategies.

The high prevalence of gastrointestinal parasites in dairy cattle indicates the necessity for improved management practices on dairy farms. This includes regular health monitoring, effective deworming regimens, and the implementation of hygienic practices in cattle rearing and handling. Educating farmers about the risks of parasitic infections and the importance of preventative measures is also crucial.

Further research is needed to explore the effectiveness of different parasite control strategies, including pasture management and targeted deworming programs. Additionally, studies focusing on the genetic resistance of cattle to certain parasites could provide valuable insights for breeding programs aimed at reducing the susceptibility of cattle to these infections.

Journal of Health and Rehabilitation Research 2791-156X JHRR

CONCLUSION

In conclusion, the study's findings contribute significantly to the understanding of gastrointestinal parasite prevalence in dairy cattle in Tehsil Gagra and have broader implications for veterinary practices, public health, and agricultural economics. The integration of these insights into practical and policy-level interventions can lead to improved animal health and productivity, ultimately benefiting both the agricultural sector and public health.

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