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Epidemiological Analysis of Gastrointestinal Parasites in Various Breeds of Cattle in the Northern Region of Khyber Pakhtunkhwa, Pakistan

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ABSTRACT

Gastrointestinal (GI) parasites are a major problem in cow production worldwide. **Objectives:** To determine how common gastrointestinal parasites are in cattle in Khyber Pakhtunkhwa, Pakistan's District Lower Dir. **Methods:** In Khyber Pakhtunkhwa's District Lower Dir, a cross-sectional descriptive design was used. Three hundred cow fecal samples were taken, and they were examined under a microscope as well as using the sedimentation and flotation techniques. To determine the impacts of breed, age, parity, eating habits, deworming status, and herd size, the data were subjected to a Chi-square test using SPSS. Overall, 67.3% of faecal samples were positive for GI parasites. **Results:** The parasites were more prevalent (41.6% each) in the Friesian and Jersey breeds. Endo-parasitic infection was higher (92.6%; p=0.04) in female cattle than in male. Less than 2 years' cattle had a higher (75.2%; p=0.101) incidence of GI parasite. Cattle reared in a mixed feeding system had a higher (91.1%; p=0.245) incidence rate of parasitic infection. Herd of ≤5 animals had 72.3% positive samples, and 6-8 animals per herd had 27.7% positive samples. Also, cattle which doesn't receive any anthelmintic drugs had a higher (53%; p=0.988) incidence rate of GI parasites than those that received anthelmintic drugs (47%). *Taxocara vitulorum* prevalence was high (46%) in single parasitic infestation, while *Taxocara vitulorum* + *Haemonchus* contortus were higher (34.6%) in double parasitic infection. *Haemonchus* + *Taxocara* + *Fasciola spp* were detected more (33.3%) in triple parasitic infection. **Conclusions:** It was concluded that the cattle population in Lower Dir had the highest prevalence of gastrointestinal parasites and needed effective control measures to enhance productivity.

INTRODUCTION

Livestock play a crucial role in the economy of Pakistan, with a share of 62.68% in agriculture value added and 14.36% in GDP [1]. Almost eight million families in Pakistan with 30–35 million rural populations are involved in livestock production activities and derive 35–40% of their annual income from this sector [2]. Livestock is a crucial asset, a key source of food and a potential source of income for the poor and landless farmers in Khyber Pakhtunkhwa and has a significant role in the provincial economy through its contribution of 57.5 % to the GNP. However, diseases and parasites are among the major constraints that impact livestock productivity, particularly for small-scale farmers, due to poor disease diagnosis and limited understanding of the risk factors, hence affecting food supplies, trade and commerce, and human health. Among parasites, the gastrointestinal parasites of different genera that inhabit the digestive tract of cattle, sheep and goats cause inappetence, poor feed utilization, anaemia, diarrhoea, poor growth, decreased milk production, morbidity, mortality hence huge economic losses to the industry [3, 4]. In Pakistan, the prevalence of the parasitic infestation is very common and causes enormous losses to livestock, with an estimated loss of Rs. 31.43 million per annum to only the sheep and goat industry in one city of Faisalabad [5, 6].

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It has been observed that the prevalence of gastrointestinal helminths is associated with agroclimatic conditions such as temperature, humidity, rainfall, quantity and quality of the feed and grazing behaviour of animals [7]. Gastrointestinal parasites have been extensively studied in Pakistan with variable results concerning the type of parasite, species of animal, agroclimatic conditions and season [8, 9]. Hence, it is of prime importance to identify the burden and types of helminths and the associated risk factors for specific areas for effective control measures. Scarce information on the prevalence of gastrointestinal parasites in different livestock species is available in the districts of Lower Dir and Upper Dir [10, 11]. However, a precise investigation on the prevalence of gastrointestinal parasites and the associated risk factors is lacking in the study area.

This study aims to explore the prevalence of gastrointestinal parasites and the associated risk factors to provide broad-based information for designing effective control measures.

METHODS

A cross-sectional descriptive design was conducted at the District Dir lower Khyber Pakhtunkhwa (KPK) [13]. The district is located between 1200 and 2800 meters above sea level in the northern KPK highlands, with latitudes of 34.35 and longitudes of 71.85. The Open Epi program was used to determine the sample size. The average annual rainfall was 1186 mm, and the average annual temperature was 16°C. During the wet and dry seasons, the relative humidity ranges from 70 to 81% and 40 to 50%, respectively. One faecal sample (~50 g) per cattle was directly collected from the rectum with gloved hands. The samples were immediately transferred to pre-labelled, hygienic plastic bottles. The sampling bottles were stored in screw caped container with ice packs and transported to laboratory. All samples were analysed for the detection of parasites within 24 h of collection. Data on breed, sex, age, herd size, deworming status and feeding pattern, date and place of sampling were recorded for each sampled animal at the time of sampling. Faecal samples were processed and examined by direct and indirect parasitological techniques (centrifugation, flotation and sedimentation) [12]. The GI parasites were identified using identification keys described by Otranto D and Wall R [13]. Briefly, faecal materials (1 g) were mixed with 0.9% normal saline wet mount solution in a mortar and a relatively homogenous preparation was obtained. The suspension was then filtered through a tea strainer. Finally, a drop of suspension was added to a glass slide and examined under a microscope. From each faecal sample, three direct smears were examined. For floatation technique, two grams of faeces was put in sterile screw caped bottle, containing 5 ml of the saline solution and was mix and strained through a sieve. The mixed matters were riddled into a centrifuge tube or a walled test tube. Formalin was added to the test tube until a convex meniscus was formed. A cover slip was positioned on the top of the test tube carefully and left for 5 minutes. The cover slip was removed from the glass tube and placed on the slide, and was tested for helminth eggs and oocysts under the microscope at 10X. In the sedimentation method, two g of faeces were mixed with 50 ml of water and sieved. The suspension was centrifuged at 1000 rpm for 2-3 minutes with a solution of NaCl. The supernatant was decanted, and from the sediment, 1 drop was taken with a Pasteur's pipette and put on a slide and examined under the microscope at 10X for the presence of helminth eggs. The data were presented in percentiles. Statistical Package for Social Sciences (SPSS) version 23.0 was used for data analysis, using the Chi-square test.

RESULTS

According to the present study, a total 67.3% samples were positive for parasitic infestation. Breed-wise analysis indicates highest (41.6% each breed) prevalence in Friesian and Jersey cow. Values are presented in percentages. The percentage value has been calculated from the total number of faecal samples examined (n=300). Data showing the overall prevalence of parasitic infestation in various breeds of cattle are presented in table 1.

Table 1: Prevalence (%) of Gastrointestinal Parasites in Various Breeds of Cattle(n=300

Breed	Sample Size	Positive	Prevalence	p-Value
Friesian	134	84%	41.6%	0.116
Jersey	111	84%	41.6%	
Achai	39	25%	12.4%	
Non-descript	16	9%	4.5%	
Total	300	202%	67.3%	

Female cattle had a high (92.6%) prevalence of GI parasites. Cattle less than 2 years old had a high (75.2%) prevalence of GI parasites. Likewise, cattle reared under a mixed-type feeding system had a higher (91.1%) incidence of GI parasites than cattle under stall feeding. Notably, 72.3% of samples were detected positive in cattle with a herd size of ≤5 animals, while 6-8 animals per herd had 27.7% positive samples for GI parasites. Cattle having no history of anthelmintic use had a 53% detection rate of parasitic infection. Those partially dewormed had a 47% detection rate (Table 2).

Table 2: The Effect of Sex, Age, Feeding, Herd Size and Deworming Status on the Prevalence of GI Parasites in Cattle Breed

Breed	Sample Size	Positive	Prevalence	p-Value
Gender				
Male	17	15%	7.4%	0.04
Female	283	187%	92.6%	

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Age (Years)				
<2	214	152%	75.2%	0.101
3-4	76	45%	22.3%	
5-6	9	4%	2%	
>6	1	1%	0.5%	
Feeding				
Mixed Feeding	277	184%	91.1%	0.245
Stall Feeding	23	18%	8.9%	
Herd Size				
≤ 5	217	146%	72.3%	0.975
6-8	83	56%	27.7%	
Deworming				
Partially Deworm	141	95%	47%	0.988
No	159	107%	53%	

Data is in percentage and has been calculated from the total number of positive faecal samples observed (n=202)

Among the reported gastrointestinal nematodes, *Toxocara vitulorum* had a high (46%) prevalence rate, followed by *Haemonchus contortus* (19%), then other parasites. Among the gastrointestinal cestodes, *Moniezia spp* had a 17% prevalence rate. In the trematode parasite, *Fasciola hepatica* had 12% positive cases. Importantly, *Taxocara vitulorum + haemonchus contortus* were more (34.6%) prevalent in double parasitic infection. While *Haemonchus + Taxocara + Fasciola spp* were detected more (33.3%) in triple parasitic infection. The species-wise prevalence of parasites in various breeds of cattle is shown in table 3.

Table 3: Prevalence of Single, Double and Triple Parasites Species in Cattle (n=200)

Parasite Species		n (%)
Nematodes	*Taxocara vitulorum*	46 (46%)
	Haemonchus contortus	19 (19%)
	Trichuris	2 (2%)
	Monezia spp	17 (17%)
	Dictyocaulus viviparus	1 (1%)
	Ostertaigia	1 (1%)
Trematode	*Fasciola hepatica*	12 (12%)
	Trichostrongylus	1 (1%)
Protozoan	*Emeria bovis*	1 (1%)
Double Infection of Parasitic Species	*Taxocara vitulorum + Haemonchus contortus*	27 (34.6%)
	Taxocara vitulorum + Fasciola hepatica	12 (15.4%)
	Haemonchus contortus + Fasciola hepatica	11 (14.1%)
	Taxocara vitulorum + Monezia spp	8 (10.3%)
	Monezia spp + Fasciola hepatica	8 (10.3%)
	Haemonchus contortus + Monezia spp	7 (9.0%)
	Taxocara vitulorum + Trichuris	3 (3.8%)
	Haemonchus contortus + Emeria bovis	2 (2.6%)
Mixed Infection of Parasitic Species	*Taxocara vitulorum+ Haemonchus contortus+ Fasciola hepatica*	8 (33.3%)
	Taxocara vitulorum+ Monezia spp + Fasciola hepatica	5 (20.8%)
	Taxocara vitulorum + Haemonchus contortus + Monezia spp	3 (12.5%)
	Taxocara vitulorum + Haemonchus contortus + Teania	2 (8.3%)
	Hamonchus contortus + Monezia spp + Fasciola hepatica	2 (8.3%)
	Taxocara vitulorum + Trichuris + Fasciola hepatica	1 (4.2%)
	Hamonchus contortus + Fasciola hepatica + Ostertegia	1 (4.2%)
	Trichuris + Heamonchus contortus + Moniezia spp	1 (4.2%)
	Heamonchus contortus + Moniezia spp + Emeria bovis	1 (4.2%)

The microscopic appearance of different parasitic species is shown in figure 1.

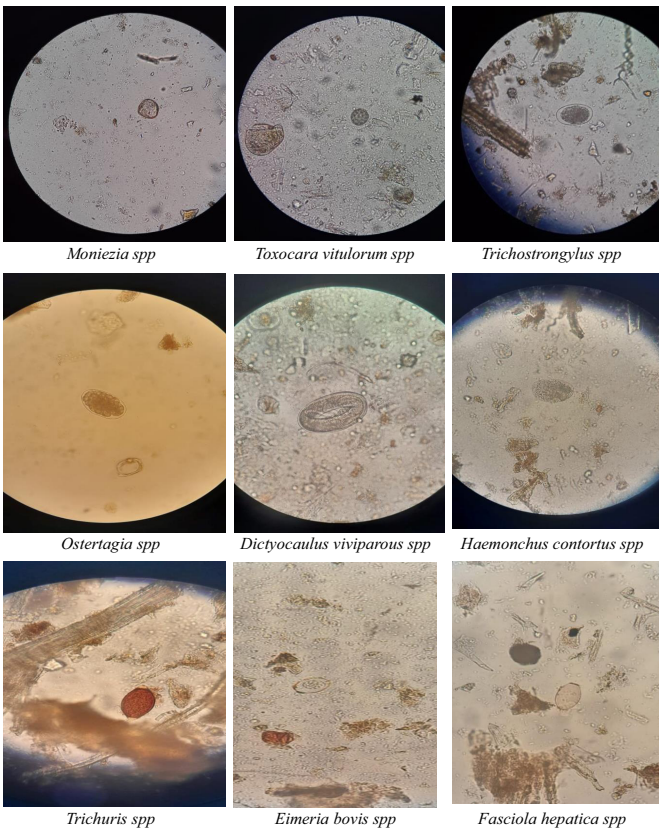

Figure 1: Different Parasitic Species

DISCUSSION

Parasitism is one of the most serious issues that the cattle population faces around the world. Parasitic diseases, particularly gastrointestinal nematode and trematode infections, pose a severe health risk to cattle and reduce output due to related morbidity, mortality, treatment costs, and control measures [14]. A thorough grasp of the disease epidemiology, pasture management, farm management techniques, and agroclimatic factors like rainfall and temperature is all necessary for the control of gastrointestinal parasite infections in animals [15]. The kind of parasite, the extent of the infestation, and additional risk variables such as species, age, and season

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all affect the outcomes of gastrointestinal parasite infections [16]. According to the present study, a total of 67.3% samples were positive for parasitic infestation. Breed-wise analysis indicates the highest (41.6% each breed) prevalence in Friesian and Jersey cows. In the previous study, Endo-parasites were detected in 43.96% of the total fecal samples, which was less than the 47.00% of Nigerian cattle housed at the study farm [17]. According to our findings, nematodes (66.99%) were the most common helminth infection, followed by cestodes (17%), and finally trematodes (13%). The parasite infection ratio is only found in one protozoan (3%). In a prior study, nematodes (72.41%) were the most common helminth infection, followed by trematodes (25.00%) and cestodes (25.00%). *Strongyles* were found in larger numbers in cattle [17]. According to our analysis, parasite infestation was highest in the friesian cross (76.6%), followed by the Jersey cross (68.6%), sahiwal (50%) and achai (48.7%). In the nondescript, the parasite infection was the lowest. A significant difference (p0.05) was also discovered in infestation levels in different breeds in the prior study, with local breed cattle (33.0%) having a higher infection rate than cross-breed cattle (19.6%). In comparison to reports of GI nematode infection in cross-breed cattle, the prevalence of GI nematode infection in cross-breed cattle was lower. The majority of the samples were gathered from the friction cross, which is why we made this remark. According to our analysis, parasitic infection was most common in animals aged 6 to 10, with a prevalence of 75%, followed by animals aged 1 to 5, with a prevalence of 67.3%, and finally, animals aged 16 to 20, with a prevalence of 67.3%. The animals in the age group 11-15 had the lowest prevalence (33.3%). The frequency of GI nematode infection was proven in the previous study about cross of age on the incidence of GI nematodes with the breed cattle was lower than, with prevalence being highest in animals aged less than 1 year on Haramaya University dairy farm on Holstein Friesian dairy breed (54 percent) of (41.30 percent), followed by juvenile (34.1 percent) and mature (23.07 percent) [18]. According to our analysis, male have the highest parasite infestation (94.1%), followed by female (94.1%). (66.8%). Infection rates were greater in female (53.63%) than in males (46.38%). Female had a higher rate of parasite infection than male; on the other hand, they had a larger endo-parasite infection percentage of *Haemonchus contortus* than female, according to [19]. The rationale for this assertion is that the male is free to roam throughout the grazing grounds, which have a higher risk of parasitic infestation. The higher prevalence of gastrointestinal parasites could be linked to cattle management. The mixed feeding group had the highest parasitic infestation in the current study's grazing pattern. The animals with the 1-4 herd size had the highest prevalence ratio in the herd size category. Among terms of deworming techniques, the highest parasitic infestation was found in animals that had never been dewormed in their whole lives [20]. The reduced frequency of gastrointestinal parasites is due to deworming and care techniques. The majority of cattle on untreated farms, on the other hand, were grazing animals who were rarely treated for GI diseases. Grazing increases the entry of various parasite stages into cattle's digestive tracts via oral ingestion. Faecal egg counts are critical indicators for determining how long cattle must be treated for worms. This can also be done following deworming treatments to see how effective a specific anthelmintic is. As a result, unwanted veterinarian services and prescription costs can be cut.

CONCLUSIONS

It was concluded that numerous internal parasites are prevalent in cattle, with a greater infection incidence in the Friesian crossbreed (76.6%). Infestation of parasitic nematodes was high (66.99%). On the other hand, the highest prevalence was recorded in male (94.1%). In the age the highest prevalence (75%) was recorded in the age group of (6-10). Under the mixed feeding pattern, parasite infestation was common in diverse management approaches. In parity, the highest prevalence (73.3%) was recorded in those cattle which have a parity level (4-6). In the deworming, the highest prevalence (70.2%) was recorded in those animals which do not properly dewormed. On the other hand, high parasite infestation occurs in the herd size due to management approaches (69.1%). The parasitic infestation grew in tandem with the herd's size.

Authors Contribution

Conceptualization: MS, IA
Methodology: MS, IA
Formal analysis: MH, MFK, FU
Writing review and editing: MZS, AJK, SB

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

All the authors declare no conflict of interest.

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