



Original Article

Prevalence and Diversity of Ovine Gastrointestinal Parasites in the District Lower Dir

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ABSTRACT

Gastrointestinal parasitism is a key challenge to sheep production globally, These parasites result in weight loss, diarrhea, anemia, and higher production costs. **Objectives:** To find out the prevalence of gastrointestinal parasites in ovine of district lower Dir Khyber Pakhtunkhwa. **Methods:** A fecal sample was taken at random from the rectum of sheep (*Ovis aries*) using gloved fingers. The faecal components were then placed in sterile plastic bottles containing 10% formalin. A total number of 584 faecal samples of sheep were collected and then analyzed for the presence of parasites. Among them, 219 sheep were male, and 365 were female. **Results:** The Overall prevalence rate was 89.04%. Most commonly, parasites were *Haemonchus spp.*, *Strongyloides spp.*, *Trichostrongylus spp.*, *Fasciola hepaticas spp.*, and *Moniezia spp.*, which were 43.27, 28.57, 15.59, 3.6, and 1.7% prevalences, respectively. Based on sex, there was a significant difference ($p < 0.05$) in the overall incidence of gastrointestinal parasites between male (33.39%) and female (55.65%) sheep. The prevalence of gastrointestinal parasites in adult sheep was higher (69.18%) than in young sheep (19.86%). The highest infection was observed in the Balkhi breed (38.7%) and the Damani breed (32.53%) in comparison to the Lokhi breed (18.32%) ($p < 0.05$). In contrast, in the tehsil-wise comparison, the maximum number of gastrointestinal parasites prevalence (17.46%) was recorded in tehsil Samar Bagh, followed by tehsil Munda 15.23%, Lal Qila 13.01%, Balambat 9.1%, and tehsil Khall 8.4%. **Conclusions:** It was concluded that parasitic spp, sex, age, breed, and different tehsils are vital factors that affect the prevalence of gastrointestinal parasites.

INTRODUCTION

Gastrointestinal Parasites (GIPs) presence is measured as one of the most hazardous physical health issues in cattle, which increase in pastures [1]. Gastrointestinal parasitism in sheep and cattle is mostly caused by helminths [2]. Trematodes gastrointestinal parasites are widely spread in ruminant animals and have a significant global presence [3]. The common gastrointestinal parasites present worldwide and can infect sheep and other small ruminant animals include *Fasciola* species, *Haemonchus* species, *Strongylus* species, and *Trichostrongylus* species [4]. It was identified that gastrointestinal parasites live inside the living host's alimentary canal, liver, gall bladder, lungs, body cavity, and intestinal tissues of blood [5, 3], which can badly infect the gastrointestinal tract of livestock [6]. A large

number of helminthiasis infections have no symptoms [7]. Due to weak immunity, animals with gastrointestinal helminth infections have reduced rates of production and reproduction and are more vulnerable to infection by other pathogens [8]. Owners suffer losses in the form of decreased milk production, low fertility, diminished work capacity, involuntary culling, treatment expenses, mortality, and decreased market value of the diseased animal [9, 10]. However, predictable procedures of worm preventions comprise the whole flock treatment with artificial vermifuge, whereas in the present era, the universal problem of vermifuge resistance/tolerance in small ruminants safeguards that consideration was also necessary to be assumed to the sustainability of vermifuge

treatment and their abrupt financial advantage [11]. Sheep parasite prevalence varies across Pakistan, with reports ranging from 25% to 92% [10]. Trematodes are one of the vital gastrointestinal parasites that can cause major infectious parasitic diseases of goats and sheep, which can produce a vital problem associated with a massive economic harm in domesticated animals by declining indirect and direct production [12]. Nevertheless, many regions of Pakistan still need to be selected for gastrointestinal parasites due to their high financial importance.

This study aims to determine the prevalence of ovine gastrointestinal parasites and to investigate the involved species and the association of several hazard factors of gastrointestinal parasites among sheep of the study area district, Lower Dir, Khyber Pakhtunkhwa, Pakistan.

METHODS

The current experimental study was restricted by the Upper Dir on the North side and East side by the district Swat. Similarly, on the West side, the district Lower Dir was bounded by Afghanistan and Bajaur Agency, while on the South side by district Malakand. The political division of the district Lower Dir and its geographic location were analyzed [13](Figure 1).

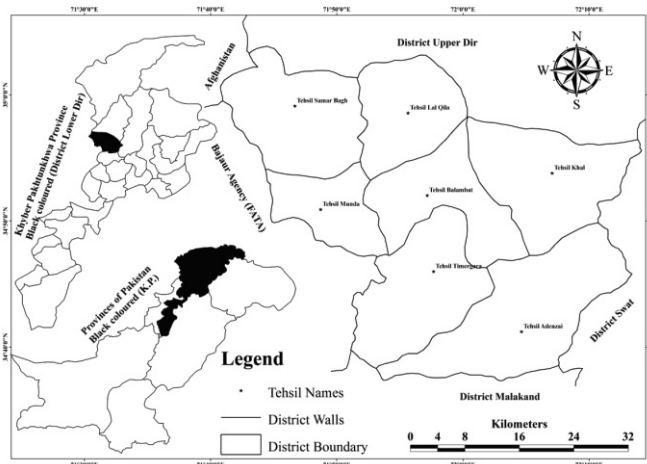


Figure 1: Political Division of the District Lower Dir and Its Geographic Location

The study population consisted of all sheep in seven tehsils of the district. Randomly fresh samples of sheep fecal samples were collected from both (male and female) sexes of sheep. The total sample size was 584 and was calculated by power analysis techniques. For the determination of age-wise prevalence, the sheep were categorized into young and adults. Sheep having age less than one year were categorized as young, while those having age more than one year were in the adults category. All ages of sheep from Lower Dir were included in this study. Besides this, all were excluded. From each sheep, the sample was collected in a sterilized polythene bag directly from the rectum.

Evidence concerning animal type, age, sex, date of animal and region from where the samples collection was noted. About 10 ml of 1% formalin was added into containers with samples and then stored for further analysis at 4°C in the refrigerator. The sedimentation technique was used for the microscopic investigation of faecal samples. The samples were centrifuged with a solution of zinc sulfate. To keep the sediment materials in the slide of glass, a pipette was used. A methylene blue drop was added on the slides and then was examined under a microscope at 4X and 10X, respectively. The eggs and larvae were properly identified based on morphological size with the help of a key developed [6, 14]. SPSS version 23.0 was used for the statistical analysis of data. Differences between host species, sex, and age groups were explored using a chi-square test. The confidence level was set at 97%, and $p \leq 0.05$ was considered significant. The relative occurrence of various helminths species or groups was designed by following the formula as used by [15]. $Prevalance \% = (\text{Number of positive samples} / \text{Total number of samples examined}) \times 100$.

RESULTS

In the present work, 584 total fecal samples of the sheep were collected from different tehsils of Lower Dir and then analyzed for the incidence of gastrointestinal (GI) parasites. Out of these 584 sheep samples, 520 sheep were infected with GIP. By class-wise prevalence, the evaluation of the present study revealed the maximum percentage of prevalence for nematodes 83.90%, followed by trematodes (3.6%) and cestodes (1.7%). There were significant ($p \leq 0.05$) differences in the prevalence of nematodes, trematodes, and cestodes (Table 1).

Table 1: Overall and Class-Wise Prevalence of Sheep Parasites

Traits	n (%)	χ^2	p-Value
Positive Cases	520 (89.04%)	0.01	0.099
Negative Cases	64 (11%)		
Total Examine Cases	584 (100%)		
Class			
Nematodes	489 (83.90%)	60.65	0.000
Trematodes	21 (3.60%)		
Cestodes	10 (1.70%)		

Out of 584, 219 were male with 195 (33.39%) positive cases, and 365 were female with 325 (55.65%) positive cases. The present study indicated that the prevalence of gastrointestinal parasites in female sheep was higher as compared to the male sheep; however, their combined prevalence was 89.04% as presented in. The current study displayed significant ($p \leq 0.05$) differences in the prevalence in both male and female sheep. In the present study, out of the total examined 584 sheep animals, 130 were young, and 454 were adult. The infection rate in young animals was

19.86%, while in adults, it was 69.18%. Thus, adults were found to be more infected with parasites as compared to young animals (Table 2).

Table 2: Sex-Wise and Age-Wise Prevalence of Sheep Parasites (n=584)

Risk Factor	Gender	No. Examine	No. Positive	Prevalence	X ²	P-Value
Sex	Male	219	195	33.390%	0.010	0.010
	Female	365	325	55.651%		
Total		584	520	89.041%		
Age	Young	130	116	19.86%	0.030	0.0000
	Adult	454	404	69.18%		
Total		584	520	89.04%		

The present study demonstrated that six species of GIPs cause prevalence to sheep belonging to three classes (Nematodes, Trematodes, and Cestodes). Among these four GIPs of nematodes, the maximum prevalence (43.27%) was caused by *Haemonchus*, followed by *Strongyloids* (28.57%), *Trichuris* (15.59%), and *Trichostrongylus* (8.57%), respectively. However, only genera of class trematodes, namely *Fasciola hepatica*, cause 3.6%, and Cestode also only species *Moniezia*, which can have a 1.7% prevalence in sheep (Table 3).

Table 3: Species-Wise Prevalence of Parasites

Classes	Genera of Helminthes	Number of Infected	X ²	P-Value
Nematodes	<i>Haemonchus</i>	212 (43.27%)	1.71	0.9443
	<i>Strongyloides</i>	140 (28.57%)		
	<i>Trichuris</i>	95 (15.59%)		
	<i>Trichostrongylus</i>	42 (8.57%)		
Trematode	<i>Fasciola hepatica</i>	21 (3.6%)		
Cestode	<i>Moniezia</i>	10 (1.7%)		
Grant Total		520/584 (89.04%)		

Among the 584 sheep breed samples, Balkhi breed, total samples 250, positive 223, Damani breed total samples 214, positive 190, Lokhi breed total samples 120, and positive cases 107. The present study revealed that the maximum prevalence was in the Balkhi breed (38.7%), followed by the Damani breed (32.53%), and the minimum prevalence was in the Lokhi breed (18.32%). The study results revealed that the overall prevalence of gastrointestinal parasites was 89.04% in sheep (Table 4).

Table 4: Breed-Wise Prevalence of Helminths' Parasites

Breed	Total Number	Positive	Prevalence	X ²	P-Value
Balkhi Breed	250	223	38.7%	0.71	0.099
Damani Breed	214	190	32.53%		
Lokhi Breed	120	107	18.32%		
Total	584	520	89.04%		

The present study revealed that higher gastrointestinal parasites positive cases 114, prevalence (17.46%) was recorded in tehsil Samar Bagh, followed by tehsil Munda

positive cases 89, prevalence (15.23%), Timergara positive cases 80, prevalence (13.69%), Lal Qilla positive cases 76, prevalence (13.01%), Adenzai positive cases 71, prevalence (12.16%), Balambat positive cases 53, prevalence (9.1%) and tehsil Khall positive cases 49 and prevalence (8.4%). The present study indicates that there were non-significant differences among all the tehsils presented (Table 5).

Table 5: Tehsil-Wise Prevalence of Gastrointestinal Parasites

Tehsil	Total Sample Size	Positive Sample Size	Negative Sample Size	X ²	P-Value
Adenzai	80	71	09 (12.16%)	0.004	1.0000
Balambat	60	53	07 (9.1%)		
Khall	55	49	06 (8.4%)		
Lal Qilla	85	76	26 (13.01%)		
Munda	100	89	11 (15.23%)		
Samar Bagh	114	102	12 (17.46%)		
Timergara	90	80	10 (13%)		
Total	584	520	64 (89.04%)		

A total number of 81 sheep was recorded in Tehsil Adenzai, in which the total number of Lokhi breed was 22, positive breed 20, Damani breed number 36, positive 31, Balkhi breed number 22 and positive Balkhi breed number 20. Similarly, a total number of 60 sheep was recorded in Tehsil Balambat, in which a total number of Lokhi breed 5, positive breed 4, Damani breed number 27, positive 24, Balkhi breed number 28 and positive Balkhi breed number 25. Similarly, a total number of 114 sheep was recorded in Tehsil Samar Bagh, comprising Lokhi breed number 8, positive breed 7, Damini breed number 16, positive 15, Balkhi breed number 90, and positive cases 90. Maximum number of breeds 114, positive cases 102 were recorded in Tehsil Samar Bagh followed by Tehsil Munda 100, positive cases 89, Timergara 90, positive cases 80, Lal Qilla 85, positive cases 76, Adenzai 81, positive cases 71, Balambat 60, positive cases 53, Khall 55 and positive cases 49 (Table 6).

Table 6: Breed-Wise and Tehsil-Wise Prevalence of Gips in Sheeps

Tehsil	Lokhi Breed		Damani Breed		Balkhi Breed		Total	
	Total	Positive	Total	Positive	Total	Positive	Total	Positive
Adenzai	22	20	36	31	22	20	80	71
Balambat	5	4	27	24	28	25	60	53
Khall	12	11	9	8	34	30	55	49
Lal Qilla	11	10	46	41	28	25	85	76
Munda	39	35	41	36	20	18	100	89
Samar Bagh	8	7	16	15	90	80	114	102
Timergara	23	20	39	35	28	25	90	80
Total	120	107	214	190	250	223	584	520

In the present study, a total number of six gastrointestinal parasites was recorded, which can infect 520 sheep. Among these, 520 were young sheep, numbered 116, and adult sheep numbered 404. The gastrointestinal parasite *Haemonchus* was found in 48 young and 164 adult sheep,

while *Strongyloides* was found in 31 young sheep and 109 adult sheep. Similarly, *Trichuris* was found in 21 young and 74 adult sheep, while *Trichostrongylus* was found in 9 young and 33 adult sheep. In contrast, gastrointestinal parasites *Fasciola hepatica* was found in 5 young sheep and 16 adult sheep, while *Moniezia* was found in 2 young and 8 adult sheep. In the current study, mostly adult sheep 404 were infested by gastrointestinal parasites as compared to young, whose respective value was 116 (Table 7).

Table 7: Species-Wise and Age-Wise Prevalence of GIPs

GIPs	Young	Adult	Total	X ²	P-Value
<i>Haemonchus</i>	48	164	212	0.090	1.000
<i>Strongyloides</i>	31	109	140		
<i>Trichuris</i>	21	74	95		
<i>Trichostrongylus</i>	9	33	42		
<i>Fasciola hepatica</i>	5	16	21		
<i>Moniezia</i>	2	8	10		
06	116	404	520		

DISCUSSION

In the present study, 584 faecal samples were examined. A total of 520 samples were found to be infected with gastrointestinal parasites, with a high overall frequency of 89.04% in the Lower Dir district. Among the examined parasites, *Haemonchus* species displayed the highest prevalence (43.37%), followed by *Strongyloides* sp. (28.57%), *Trichuris* sp. (15.59%), *Trichostrongylus* sp. (8.57%), *Fasciola* sp. (3.6%), and *Moniezia* sp. (1.7%). The present work is compared with other investigations. In many other regions of Pakistan, nematodes had the highest prevalence, followed by trematodes and cestodes. Nevertheless, the current outcome differed from the findings of Kann et al., who reported higher prevalence values (71.10%) for *Strongyloides* in cattle from the northern causal region of Colombia [16]. This result was also different from the findings of other researchers like Trinidad et al., who reported 73.0% and 60.60% prevalence in cattle from Peru and Mexico, respectively [17]. In the present study, a high prevalence (89.04%) of infections was recorded in sheep. The current findings were in line with earlier research by Abebe et al., which reported 80%, 83.24%, 82%, 81.1%, 77.4%, 86.6%, 87.5%, and 78.31% from Magadi division, south-western Kenya, Jammu district, India, Rawalpindi, Islamabad, Pakistan, Patiala, and its surrounding areas, respectively [18]. These studies also reported nearly identical prevalence in sheep with only small differences. Maximum prevalence was found in the country's diver region, which was linked to overstocking, inadequate nutrition (starvation), a lack of animal management skills (cleanliness), and frequent exposure to contaminated communal grazing areas [19]. Similarly, the prevalence of *Strongyloides* species in the present study

area was 28.57%, and 26.2% *Strongyloides* species, which was the second prevalent parasite after *Haemonchus* species from Tulus study area [7]. The present study displayed a 15.59% prevalence of *Trichuris* in sheep. The prevalence of *Trichuris* species as compared to the previous finding, that 1.2% was reported by Rana & Subedi, and 8% by Acharya [20, 21]. Our study's the incidence of *Trichostrongylus* species was lower than that of previous investigations, which found that 48.8% of Bedelle, South-Western Ethiopia, Jimma town, Western Ethiopia, and Patiala had the species, 26.20% by Ibrahim et al., and 3.30% by Kenea et al., [22, 23]. Similar findings were previously reported for *Fasciola* species in Samba, Jammu district, India, Islamabad, and Rawalpindi, Pakistan, with prevalences of 0.5% by Ayvazoğlu et al., and 4.56 by Mohammed et al., respectively [24, 25]. However, the current study's findings on the prevalence of *Fasciola* species in sheep were lower than those of previous studies, which found that the prevalence of *Fasciola* gastrointestinal parasite species in sheep was 8.4% in Tangail district [26], 9% in Bako town Western Ethiopia Abebe et al., [18], 15.18% in Pakistan [27], and 19.60% in India [22]. This could be due to the agroclimatic environments such as quality and quantity of humidity, temperature, pasture, and environmental conditions. In contrast to the previously recommended report of [28], which stated that the prevalence of *Moniezia* species in sheep was 0.96%, Bhat et al., 3.0% [29] and 3.8% from the Bishnah, Kashmir valley of India, Nile-Delta, and Egypt, respectively, the current study found a 1.7% prevalence in sheep of this species. Although Abebe et al., found a 7.30% prevalence [18], Mohammed et al., found a 5.77% prevalence [25], Ibrahim et al., found a 13.10% prevalence [22], and Acharya found an 11.70% prevalence in sheep from Bako town, Western Ethiopia, Indore, Patiala, and southern Rajasthan, India respectively [21]. Animal feed and drinking water become contaminated during the rainy season. As a result, helminthic and protozoan infections were likely to be most common during the rainy season [27]. Rainfall encourages pre-parasitic larval phases to grow. Gastrointestinal parasite prevalence depends on the availability of suitable transitional hosts, which might vary over time. Snails, which are carriers of several endoparasites, are typically at their highest during the mason season [30].

CONCLUSIONS

It was concluded that maximum gastrointestinal parasites prevalence in tehsil Samar Bagh followed by tehsil Munda, Timergara, Lal Qilla, Adenzai, Balambat and lower prevalence in tehsil Khall respectively. In these tehsils of the district Lower Dir, the recorded helminth parasites include nematodes, trematodes, and cestodes. Maximum

gastrointestinal parasitic infection was caused by nematodes, while minimum by cestodes. It was also reported that the GIPs infection was more prevalent in female sheep as compared with male. Maximum infection of GIPs prevalence was recorded in the Balkhi breed, followed by the Damani breed, and minimum in the Lokhi breed. It was investigated that the adult sheep were more infected as compared to young sheep.

Authors Contribution

Conceptualization: RK

Methodology: RK, AS, MY

Formal analysis: RMK

Writing review and editing: SS, KK, AI

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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