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Anurag Jena
Department of Veterinary Parasitology, Ranchi Veterinary College, Kanke, Ranchi, Jharkhand, India

Asit Ranjan Deb
Department of Veterinary Parasitology, Ranchi Veterinary College, Kanke, Ranchi, Jharkhand, India

Lalita Kumari
Department of Veterinary Parasitology, Ranchi Veterinary College, Kanke, Ranchi, Jharkhand, India

Subhranshu Sekhar Biswal
Department of Argo, CVSc. & A.H, KVK, Jharsuguda, OUAT, Bhubaneswar, Orissa, India

SK Joshi
Scientist Animal Science, KVK, Jharsuguda, OUAT, Bhubaneswar, Orissa, India

Correspondence
Anurag Jena
Department of Veterinary Parasitology, Ranchi Veterinary College, Kanke, Ranchi, Jharkhand, India

Pattern of occurrence of gastrointestinal helminthiasis in Chottanagpuri sheep in and around Ranchi, Jharkhand

Anurag Jena, Asit Ranjan Deb, Lalita Kumari, Subhranshu Sekhar Biswal and SK Joshi

Abstract
During the present study, a total of 1506 fecal samples of Chottanagpuri sheep in and around Ranchi, were examined, out of which 942 were found positive for gastrointestinal helminthiasis and showing overall prevalence rate of 62.55%, of which trematodes were 467 (31.01%), cestodes were 329 (21.85%) and nematodes had highest prevalence *i.e.* 588 (39.04%) with a mixed infection of 442 (29.35%). Different trematodes detected were *Fasciola* spp. (28.49%) and *Paramphistomum* spp. (29.28%); only *Moniezia expansa* (21.18%) and *Moniezia benedeni* (12.42%) were detected in cestodes and the nematodes found were *Strongyloides* spp. (21.51%), *Trichostrongylus* spp. (6.24%), *Haemonchus* spp. (36.59%), *Trichuris* spp. (11.69%), *Oesophagostomum* spp. (23.44%), *Bunostomum* spp. (1.06%), *Ostertagia* spp. (13.08%) and *Cooperia* spp. (1.26%). Highly significant correlation (P<0.01) was recorded between animals infected and different GI helminth infections. The present research provided the prevalence pattern and risk factors associated with gastrointestinal helminthiasis.

Keywords: Gastro-intestinal helminths, Ranchi prevalence, Chottanagpuri sheep, helminth epidemiology

Introduction
India has a population of 65.1M sheep, of which Jharkhand accounts to 583 thousand sheep [1]. It plays an important role in Indian economy. Gastrointestinal parasitism leads to severe health ailments, limiting productivity of the animal [2]. Although production losses piles upto millions of rupees, [3] this problem is neglected time and again due to, its chronic and insidious nature [4]. As a result, it remains a major impediment in small ruminant production and this problem is severe in the tropics due to highly favorable environmental conditions for helminth transmission [5]. Epidemiological pattern of gastrointestinal helminthiasis would provide a basis for evolving strategic and tactical control of these diseases [2]. Studies concerning prevalence of gastrointestinal helminthiasis in Chottangpuri sheep of Jharkhand has been scant or absent. Present work was aimed to access the prevalence and risk factors associated with gastrointestinal helminthiasis in Chottanagpuri sheep in and around Ranchi, Jharkhand.

Materials and Methods
The present study was conducted on fecal sample basis, fecal samples were either collected freshly void or directly from the animal with prior permission of the owners.
Ranchi is located in southern part of Chota Nagpur plateau nearer to Tropic of Cancer and lies at 23˚22'N 85˚20'E, its average elevation is 651m above sea level. It covers a geographical area of 175.12 Km^2 with dense tropical forest and hilly topography. Ranchi experiences an annual rainfall of 1430 mm with minimum and maximum temperatures ranging from 0 to 25˚C in winter and 20 to 42˚C in summer, respectively [6]. The Study was conducted from July, 2012 to June, 2013.
The fecal samples were collected from 1506 Chottanagpuri sheep from different localities in 5 blocks of Ranchi district of Jharkhand. The helminth eggs were detected with Modified Sheather's Sugar floatation technique [7] and Formal ether acetic acid technique (for trematodes) [8].
The association of different risk factors (*i.e.* season, age and sex) with the prevalence of GI helminthiasis was tested employing Chi-square test of independence of attributes. Risk factor Correlations with P<0.05 were considered significant and P<0.01 were considered highly significant [9].

Results

During the present study, a total of 1506 fecal samples of Chottanagpuri sheep were examined, out of which 942 were found positive for gastrointestinal helminthiasis and showed an overall prevalence rate of 62.55%, of which trematodes were 467 (31.01%), cestodes were 329 (21.85%) and nematodes had highest prevalence *i.e.* 588 (39.04%) with a mixed infection of 442 (29.35%) as shown in Table 1. Highly significant correlation (P<0.01) was observed between animals infected and different GI helminth infection. Different trematodes detected were *Fasciola* spp. (28.49%) and *Paramphistomum* spp. (29.28%); only *Moniezia expansa* (21.18%) and *Moniezia benedeni* (12.42%) were detected in cestodes and the nematodes found were *Strongyloides* spp. (21.51%), *Trichostrongylus* spp. (6.24%), *Haemonchus* spp. (36.59%), *Trichuris* spp. (11.69%), *Oesophagostomum* spp. (23.44%), *Bunostomum* spp. (1.06%), *Ostertagia* spp. (13.08%) and *Cooperia* spp. (1.26%) as given in Table 2.

Rainy season showed the highest prevalence, 410 (73.21%) followed by winter, 266 (60.73%) and lowest was seen in summer, 266 (52.36%). Among trematodes highest prevalence was seen in rainy, 264 (47.14%) and lowest in winter at 83 (18.95%) with 120 (23.62%) infections in summer season. Cestodes were equally distributed in all seasons showing a slightly higher prevalence in rainy season, 132 (23.57%). The nematodes were highly prevalent in rainy (268; 47.86%) and winter (195; 44.52%) with lowest prevalence recorded from summer season (125; 24.61%). Mixed infections were recorded to be highest in rainy (254; 45.36%) followed by winter (107; 24.43%) and summer (81; 15.94%) seasons. No seasonal correlation (P>0.05) was observed among cestodes but all other groups of helminths and overall GI helminthiasis were observed to have highly strong statistical evidence (P<0.01) of relationship with season as a risk factor (Table 1).

Overall age wise prevalence was recorded to be highest in 0-3 month age group (543; 66.14%) followed by 4 to 9 month age group (269; 60.86%) and more than 9 month age group which showed least prevalence of 130 (53.5%). Trematodes were recorded to be most prevalent in 0-3 month age group, 306 (37.27%) and least prevalent in 4 to 9 month age group, 82 (18.55%) with 79 (32.51%) infection in more than 9 month age group. Cestodes showed higher prevalence in >9 month (87; 35.8%) and 4-9 month (144; 32.58%) age group with lower prevalence being recorded in 0-3 month age group (98; 11.94%). Among, nematodes the highest prevalence of gastrointestinal helminthasis was to be recorded in the age group of 4-9 month, 231 (52.26%) and lowest was recorded in the age group of 0-3 month. 132 (54.32%) out of 243 were found positive for mixed infections in >9 month age (highest) group where as lower prevalence rates were recorded in 0-3 month age group, 122 (14.86%) as shown in Table 1. All GI helminths and overall GI helminthiasis show strong statistical evidence of relationship between different age groups (P<0.01).

Table 1: Prevalence of Gastrointestinal helminthes in Chottanagpuri sheep in and around Ranchi

		Overall G.I. helminths		Trematodes		Cestodes		Nematodes		Mixed Infection		X^2;P value
Group	N	P	PR%	P	PR%	P	PR%	P	PR%	P	PR%	106.46**;
	1506	942	62.55	467	31.01	329	21.85	588	39.04	442	29.35	0.00
Season												
Rainy	560	410	73.21	264	47.14	132	23.57	268	47.86	254	45.36	
Winter	438	266	60.73	83	18.95	95	21.69	195	44.52	107	24.43	
Summer	508	266	52.36	120	23.62	102	20.08	125	24.61	81	15.94	
X^2 ; P value		50.32**; 0.00		110.87**; 0.00		1.91^{NS}; 0.38		68.29**; 0.00		118.34**; 0.00		
Age												
0-3 month	821	543	66.14	306	37.27	98	11.94	261	31.79	122	14.86	
4 to 9 month	442	269	60.86	82	18.55	144	32.58	231	52.26	188	42.53	
>9 month	243	130	53.5	79	32.51	87	35.8	96	39.51	132	54.32	
X^2 ; P value		13.55**; 0.001		47.37**; 0.00		104.76**; 0.00		50.62**; 0.00		193.26**; 0.00		
Sex												
Male	576	326	56.6	153	26.56	113	19.62	186	32.29	126	21.88	
Female	930	616	66.24	314	33.76	216	23.23	402	43.23	316	33.98	
X^2 ; P value		14.12**; 0.00		8.62**; 0.003		2.71 ^{NS}; 0.1		17.87**; 0.00		25.13**; 0.00		

N- Total no. of sheep examined; P -Total no. of sheep positive; PR% - Prevalence rate (%); X^2 - Chi Square value; NS - Non-significant; ** - Highly significant relationship

Table 2. Overall prevalence of gastrointestinal helminthes in Chottanagpuri sheep in and around Ranchi

Gastrointestinal Helminths	Number of Positive	Percentage
Haemonchus spp.	551	36.59
Oestertagia spp.	197	13.08
Trichuris spp.	176	11.69
Oesophagostomum spp.	353	23.44
Trichostrongylus spp.	94	6.24
Bunostomum spp.	16	1.06
Strongyloides spp.	324	21.51
Cooperia spp.	19	1.26
Fasciola spp.	429	28.49
Paramphistomum spp.	441	29.28
Moniezia expansa	319	21.18
Moniezia benedeni	187	12.42

Females, 616 (66.24%) were recorded to be more susceptible than males 326 (56.6%) for overall GI helminth infection. Among, different GI parasites *i.e.* trematodes, cestodes and nematodes, all showed higher prevalence in females (33.76%; 23.23% and 43.23%), while males were recorded to have lower prevalence rates (26.56%; 19.62% and 32.29%). Similarly, mixed infections were also seen to be higher in females, 316 (33.98%) than males (21.88%). The details are shown in Table 1. Overall GI helminthiasis has highly significant (P<0.01) relationship between males and females. The same is also true for trematodes, nematodes and mixed infection (P<0.01) but cestodes infection has no such relationship with males or females.

Discussion

In the present study, in Chottanagpuri sheep, various species of gastrointestinal helminths were detected, similar reports have been recorded by many researchers in different climatic areas of India [9, 11, 23, 25] along with other parts of the world [10, 12, 13, 22, 24]. There are a number of factors that could have influenced the prevalence of

gastrointestinal helminths such as grazing habitat, economic and educational capacity of the farmers, anthelmintics used and the managemental practices [3, 4, 24]. The higher overall prevalence of GI helminths at 62.55% (Table 1) is in accordance to Gupta *et al.* in 2013 [5] and Poddar *et al*. [10], Islam *et al*. [15], Ahmed *et al*. [24], Sanalkumar *et al*. [23] and Sohail *et al*. [26] in 2017. Nematode (39.04%) prevalence was significantly higher in the study population, which justified the findings other workers [11, 13, 14]. *Haemonchus* spp. (36.59%) (Table 2) was recorded to be highest among the GI helminths which is in accordance to findings of other researchers [9, 22, 26]. Among nematodes prevalence of *Haemonchus* spp. was followed by *Oesophagostomum* spp. (23.44%), similar findings were recorded Nasreen and coworkers in 2005 [19] at Jammu and Kashmir. The higher prevalence of Haemonchus could be attributed to its adaptability in a number of climatic conditions such as tropical, subtropical and also temperate climates [9].

In the present study it has been observed that out of the three seasons, the highest prevalence (P<0.01) of GI helminths was recorded in rainy season followed by winter and summer. These findings are in consistent with a number of other published reports [20, 23, 25]. The higher prevalence of gastrointestinal helminths can be attributed to various favorable climatic conditions, *viz.*, humidity, rainfall, soil salinity, ambient temperature. These help in adequate growth and development of infective larval stages leading to their increased availability in rainy season and its well documented that seasonal pasture contamination and availability of infective larval stages is directly related to gastrointestinal helminthiasis in grazing animals [4, 20]. It can also be attributed to suitable molarities of soil salts which are paramount for ecdysis and is achieved during high rainfall [21]. Hutchinson and co workers in 1972 [18] have reported that arrested development of larvae is evident in winter season due cold stimuli. Animals are also stall fed during winter season, which also decreases the chances of infection [18]. These factors lead to lower prevalence in winter season.

Age-wise prevalence of GI helminths was much higher in younger animals (P<0.01) than adults because of their underdeveloped immune system leading to low resistance and high susceptibility in the animals of lower age group(0-3months of age). These observations are in accordance to the findings of several published workers in India and abroad [9, 10, 26]. Soulsby [7] was of the opinion that previous infections and age of the host animal provides substantial protection against reinfection and therefore, acute disease is most common in younger animals.

The sex wise prevalence was significantly higher (P<0.01) in female Chottanagpuri sheep than their male counterparts. These findings are in accordance with Islam *et al.* [15] who found significantly higher prevalence in females (83.6%) than males (64.7%) at Mymensingh, Bangladesh in 2017. In 2017, Azrul and coworkers [16] also found higher prevalence in females (75.42%) goats than males (56.72%) in Bangkok, Thailand. However, inconsistent results were also observed by Asif *et al.* (2007) [17] and Raza *et al.* (2014) [13] in Pakistan and Yeasmin *et al.* (2015) [14] in sheep at Bangladesh. Higher infection rate in females might be due to stress and low immune status during pregnancy, post parturient period and also during the lactional period [12].

Conclusion

The present study recorded higher prevalence of gastrointestinal helminthiasis in Chottanagpuri sheep in and around Ranchi. Among, these helminths, *Haemonchus* spp was most prevalent followed by *Paraamphistomum* spp., *Fasciola* spp., *Oesophagostomum* spp., *Strongyloides* spp. *Moniezia expansa*, *Oestertagia* spp., *Moniezia benedeni*, *Trichuris* spp., *Trichostrongylus* spp. and least prevalence was recorded in *Bunostomum* spp. and *Cooperia* spp.

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