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Research Article

Prevalence and Associated Risk Factors of Gastrointestinal Parasites in Cattle in Sirajganj, Bangladesh

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Abstract | Gastrointestinal parasitic infection is one of the major problems for profitable livestock production in Bangladesh. The purposes of the study were to identify common gastrointestinal parasites and to explore the associated risk factors of parasitic infections in cattle from Sirajganj, Bangladesh by using Stoll's ova counting technique. During the study period, 350 fecal samples from cattle were examined of which 259 animals were found to have one or more GI (gastrointestinal) parasite species, resulting in an overall prevalence of 74%. The parasites species identified in this study were namely, *Paramphistomum* spp.(40%), *Fasciola gigantica* (16%), *Schistosoma indicum* (28%), strongyles (30%), *Oesophagostomum* spp. (10%), *Moniezia* spp. (20%), *Eimeria* spp. (26%) and *Balantidium coli* (38%) respectively. In this study, *Paramphistomum* spp. infections had highest prevalence while *Oesophagostomum* spp. had lowest. Among 350 animals, an overall prevalence of trematode infections was recorded as 62.3% followed by nematode infections (37.5%) and cestode infections (20%). Calves and young cattle were significantly ($p<0.05$) more likely to be susceptible to GI parasitic infections than the adult cattle. The prevalence of GI parasitic infections was significantly ($p<0.05$) higher in poor BCS and in medium BCS than healthy cattle. Crossbred animals were 2.13 times more likely to be vulnerable to GI parasites infection than the indigenous animals. In farm mangement system, the higher prevalence rates of GI parasites infections were found in non-concrete housing (78.9%) than concrete housing, small herds than large herds and mixed farming than single farming nature. According to this study, it was concluded that *Paramphistomum* spp. are the parasites that affect cattle most frequently. In order to prevent parasitic illnesses in cattle, it is advised to focus on correct management, regular deworming, and increased hygiene.

Keywords | Gastrointestinal parasites, Prevalence, Risk factors, Bangladesh

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INTRODUCTION

Cattle comprise an important component of the livestock sector in Bangladesh. Cattle are the main source of animal protein as they give meat, milk and also source of draft power, hides etc. The growth, development and productivity of cattle are adversely affected by many diseases including gastrointestinal (GI) parasitic infections (Thapa *et al.*, 2020). Acute cases of GI parasitic infections may cause the death of the animals while chronic cases lead to loss of appetite, diarrhea, weight loss, anemia, abortion, infertility, bottle jaw including reduced disease resistance and higher mortality (Radostits *et al.*, 1994). GI parasitic infections also contributes economically by adding an extra

cost associated with their treatment, control and preventive measures. Various risk factors such as host species, age, sex, body condition, breed of the animals, parasite species and intensity of the worm population play an important role in the pathology of GI parasitic infections in animals (Badran *et al*., 2012).

The climatic conditions in Bangladesh are ideal for the survival, growth, and reproduction of many parasites. Different parasite prevalence rates in livestock have been recorded from various Bangladeshi regions (Alim *et al*., 2012). Gastrointestinal (GI) parasites cause impaired digestion and also affect the absorption of minerals particularly the calcium and phosphorus. GI parasites are also serious problems for ruminants, especially young animals. Debnath *et al*., (1995) reported that 50% calves up to 1 year of age died due to GI parasites that cause digestive disturbances and malnutrition leading to calf mortality.

Gastrointestinal (GI) parasitic infections are still a major problem for efficient and profitable livestock farming worldwide (Claerebout *et al*., 2018). Various risk factors related to host and environments play an important role in the onset of GI parasitic infections. Environmental factors include agri-ecological conditions, animal husbandry practices such as housing system, deworming intervals and pasture management; these largely determine the type, incidence and severity of various parasitic diseases (Badran *et al*., 2012). Parasitic problems are often neglected and overlooked as majority of the infected animals show a number of little obvious clinical signs during their productive life and their effects are gradual and chronic (Tariq *et al*., 2010).

Sirajganj district is a densely populated area and almost all houses keep cattle. Cattle population serves as a source of draft power for agriculture and subsistence income and as a poverty alleviation tool among the poor farmers and destitute women. The climatic condition and topography of this area is highly favorable for growth development of parasites and their vectors. However, there seems to be paucity of reports on epidemiology of some common gastrointestinal parasites in cattle at Sirajganj. This study was undertaken to examine the prevalence of some common gastrointestinal parasites with related risk factors (age, sex, body condition, breed, housing, management system, types of animal rearing system) in Sirajganj, Bangladesh, which will be used as baseline study for prevention and control of gastrointestinal parasites in cattle sector.

MATERIALS AND METHODS

Study area and selection of animals

Samples were collected from the different cattle farms of Sirajganj district for the availability of the animals. Sirajganj District area 2497.92 sq km, located in between 24°01' and 24°47' north latitudes and in between 89°15' and 89°59' east longitudes. A total of 350 cattle were selected randomly for collection of fecal samples irrespective of their age, sex, BCS, breed, herd size, housing, management and types of rearing system. These information regarding the animals' identities were collected through a semi structured questionnaire. The age of the sampled animals was determined by interrogating the farmers. The age of the animals was categorized into three groups viz. 1-12 months, >1-3 years and >3 years old by observing the eruption chart of teeth and interviewing the cattle owners (Samad, 2001). To study the influence of sex on parasitic infection, the cattle were categorized into male and female groups. According to body condition score (BCS), cattle were also categorized into three groups on the basis of their health status, viz. poor body conditioned animal (BCS ≤2; body with less flesh, remarkable bony prominence externally and rough hair coat), medium body conditioned animal (BCS>2-3), and good body conditioned animal/healthy (BCS >3-5; the animals are well fleshed with smooth hair coat and bones are not so prominent externally) following parameters described previously (Mushtaq *et al*., 2012). During collection of the samples, breed of animals, housing, herd size, floor condition, farming nature, physiological condition of the animals, BCS and types of animals rearing system were also recorded.

Fecal sample collection and examination

After taking all the relevant information, the fecal samples were collected directly from the rectum of the animals or immediately after defecation. About 5-10 g of feces were collected from each animal. Each sample was kept in separate polythene bag, tied carefully and numbered properly and transferred to the laboratory. The fecal samples were examined by Stoll's ova counting technique for counting the number of EPG of feces and identification of egg of different parasites was performed with the help of compound (X10) microscope by their characteristic morphological features (Soulsby, 1982; Thienpont, 1986). Stoll's Ova Counting Technique was performed for counting the total.

Statistical analysis

Statistical analyses were carried out by Statistical Package for Social Science (SPSS, version 25) using Chi square test. Odds Ratio also was calculated according to the formula given by Schlessman (1982). Data were initially arranged for univariate analysis in order to determine the effect of individual factors on GI parasitic infection. For multivariate analysis, the variables that produced significant results ($p<0.05$) in the univariate analysis were chosen as potential candidates for multiple regression analysis.

Table 1: Overall prevalence of GI parasites in cattle from Shahzadpur upazila of Sirajganj district of Bangladesh.

Identified parasites	No. of infected animals (%)	95 % confidence interval (CI)	EPG	
			Range	Mean±SE
Paramphistomum spp.	140 (40.0)	34.8-45.3	100-600	142.0±20.117
Fasciola gigantica	56 (16.0)	12.3-20.3	100-300	70.0±12.724
Schistosoma indicum	98 (28.0)	23.4-33.0	100-1300	72.0±5.357
Strongyles	105 (30.0)	25.2-35.1	100-600	86.0±8.224
Balantidium coli	133 (38.0)	32.9-43.3	100-1800	194.0±20.012
Oesophagostomum spp.	35 (10.0)	7.06-13.6	100-200	20.0±2.832
Eimeria spp.	91 (26.0)	21.5-30.9	100-1600	286.0±26.871
Moniezia spp.	70 (20.0)	15.9-24.6	100-800	88.0±10.186
Total (N=350)*	259* (74.0)	69.1-78.5	100-2900	958.0±48.627

EPG = Egg per gram of feces; SE = Standard error; CI = Confident interval.

RESULTS

Overall prevalence of GI parasites of cattle

During the study, a total of 350 cattle were examined using modified Stoll's Ova counting methods, and 259 animals were found to have one or more GI parasite species, resulting in an overall prevalence of 74%. A total of six (06) genera of helminth parasite eggs, cysts, and oocysts were found, along with two (02) genera of protozoa**.** Among the identified eggs of GI parasites, three genera were trematodes, namely *Paramphistomum* spp. (40%), *F. gigantica* (16%), *Schistosoma indicum* (28%), three genera of nematodes viz. strongyles (30%) and *Oesophagostomum* spp. (10%) and, single genera of cestodes, *Moniezia* spp. (20%) and two genera of protozoa, namely, *Eimeria* spp. (26%) and *Balantidium coli* (38%) respectively. In this study, *Paramphistomum* spp. infections had highest prevalence (40%) while *Oesophagostomum* spp. infections had lowest (10%) (Table 1). The highest EPG (100-1800) was estimated in *Balantidium coli* followed by *Eimeria* spp. (OPG: 100-1600), *Schistosoma* spp. (EPG: 100-1300), *Moniezia* spp. (100-800), strongyles (100-600) and *Paramphistomum* spp. (EPG: 100-600). However, lower EPG were determined in, *Fasciola gigantica* (EPG: 100-300) and *Oesophagostomum* spp. (100-200) (Table 1).

Overall prevalence of trematode, cestode and nematode infections in cattle

Among 350 animals, an overall prevalence of trematode infections was recorded 62.3% followed by nematode infections 35.7% and cestode infections 20% (Table 2).

Age related prevalence of GI parasitic infections in cattle

Various age groups of cattle were examined for the prevalence of GI parasite infections. Calves (<1 year old) had the highest prevalence of GI parasite infection, 80%, followed by young cattle (1-3 years old) and adult cattle (>3 years old) had the lowest incidence, 64.3%. The results showed that the prevalence of GI parasitic infections was significantly ($p<0.05$) higher in both calves and young cattle compared to that of adult (Table 3). Calves and young cattle were 2.22 and 1.11 times more likely to be susceptible to GI parasitic infections than the adult cattle. Age influenced the occurrence of GI parasites infection and identified as risk factor (Table 4).

Table 2: Overall prevalence of Trematode, Cestode and Nematode infectios in cattle from Shahzadpur upazila in Sirajganj district of Bangladesh.

Variables	Number of infected animal	Prevalence (%)	95 % confidence interval (CI)
Trematode	218*	62.3	56.98-67.38
Cestode	70*	20	15.94-24.58
Nematode	125*	35.7	30.69-40.98

*=Total number of animals infected is less than the summation of individual infection because same animal was infected by more than one gastrointestinal parasite. SE= Standard error; CI= Confident interval.

Sex related prevalence of GI parasitic infections in cattle

In this study, it was found that the prevalence of GI parasite infections was significantly ($p<0.05$) higher in female animals 81.8% than in male animals 58.8% (Table 3). The results showed that females were significantly ($p<0.05$) more likely to infect with GI parasitic infections, and they were 3.15 times more likely to be susceptible than males to GI parasite infection. This was recognized as one of the risk factors in the study area (Table 4).

Breed related prevalence of GI parasitic infections in cattle

In this study, the prevalence of GI parasite infections was greater in crossbred breeds of cattle, 81.8% than in indigenous breeds, 67.9%, which was statistically significant ($p<0.05$) (Table 3). In this study, crossbred animals were 2.13 times more likely to be vulnerable to GI parasites

Table 3: Determination of the significance association between the presence of GI parasites and the exposure variables using descriptive statistics and univariate analysis.

Variables	Categories	No. of infected animals (%)	95 % confidence interval (CI)	EPG	p values
				Mean±SE	
Age	Calf (<1 year)	168 (80.0)	73.9-85.2	1180.0±64.9	0.007*
	Young (1-3 Years)	28 (66.7)	50.5-80.4	666.7±110.4	
	Adult (>3 years)	63 (64.3)	53.9-73.7	607.1±77.6	
Sex	Male	70 (58.8)	49.4-67.8	588.2±68.1	0.0001*
	Female	189 (81.8)	76.2-86.6	1148.5±61.2	
Breed	Indigenous	133 (67.9)	60.8-74.3	782.1±61.6	0.003*
	Crossbred	126 (818)	74.8-87.6	1181.8±74.2	
BCS	Poor	161 (88.5)	82.9-92.7	1357.7±61.2	0.0001*
	Medium	56 (80.0)	68.7-88.6	700.0±93.7	
	Healthy	42 (42.9)	32.9-53.3	400.0±78.6	
Physiology	Pregnant	82 (83.7)	76.4-91.0	1335.7±94.6	0.006*
	Non pregnant	126 (66.7)	59.5-73.3	711.1±57.5	
	Lactating	51 (80.9)	71.2.5-90.6	844.4±65.8	

*= Significance at .05 threshold; EPG= Egg per gram of feces; SE= Standard error.

infection than the indigenous animals and the results was statistically significant (P<0.05). Cattle breed was also discovered as possible risk factors (Table 4).

Table 4: Identification of possible risk factors associated with the prevalence of GI parasites of cattle using multivariate logistic regression model.

Factors	Categories	Odds ratio	95% confidence interval (CI)	p-value
Age	Calf (<1 year)	2.22	1.3029-3.7902	<0.01*
	Young (>1–3 years)	1.11	0.5180-2.3833	>0.05
	Adult (>3 years)	1	Referance	-
Sex	Male	1	Referance	-
	Female	3.15	1.9201-5.1678	<0.0001*
Breed	Indigenous	1	Referance	-
	Cross	2.13	1.2832-3.5408	<0.01*
BCS	Poor	10.22	5.5782-18.7324	<0.0001*
	Medium	5.33	2.6240-10.8401	<0.0001*
	Healthy	1	Referance	-
Physi-ological condition	Pregnant	2.56	1.3852-4.7405	<0.01*
	Non pregnant	1	Referance	-
	Lactating	2.13	1.0576- 4.2698	<0.05*

*= Significance at 0.05 threshold.

Health status (BCS) related prevalence of GI parasitic infections in cattle

In this study, the prevalence of GI parasitic infections was significantly (p<0.05) higher in poor BCS, 88.5% followed by 80% at medium BCS and lowest prevalence of GI parasites was found in the healthy cattle (Table 3). The poor and medium BCS animals were 10.22 and 5.33 times more likely to be susceptible to GI parasitic infections than the healthy cattle and this was statistically significant (p<0.01) (Table 4).

Physiological conditions related prevalence of GI parasitic infections in cattle

In this study, pregnant animals were found to have a significantly higher prevalence of GI parasitic infections at 83.7% followed by lactating animals, who had an infection rate of 80.9% and non-pregnant animals, who had an infection rate of 66.7% (Table 3). The lactating and pregnant animals had 2.13 and 2.56 times more vulnerable to develop GI parasitic infections than the non-pregnant cattle respectively. The relation was statistically significant (p<0.05) (Table 4).

DISCUSSION

Different parasite genera cause gastrointestinal (GI) parasitism that reside in the digestive tracts of animals, which results in inappetence, anemia, digestive disturbances/diarrhea, retarded growth, decreased production, impaired reproductive performance, mortality, and economic losses in the herd (Raza *et al.*, 2007). The GI parasitism is one of the primary health issues affecting the productivity and production of cattle all over the world (Urdaneta *et al.*, 2011). Since the majority of infected cattle exhibit little overt clinical symptoms during their reproductive lives, the impacts of GI parasitism are frequently ignored and overlooked (Raza *et al.*, 2010). A variety of intestinal parasites affect cattle of all ages; however, these diseases are rarely related to high cattle death rates (Gunathilaka *et al.*, 2018).

In this study, an overall prevalence of GI parasitic infections of cattle in Sirajganj district of Bangladesh was recorded 74%. The findings of the current study are in agreement with earlier findings of Haq (2012) where in Mohangonj in the Netrakona district of Bangladesh, where it was noted that there was an overall prevalence of various helminths affecting cattle was 76.04% (Haq, 2012). The current findings are also consistent with earlier research where the author discovered that, respectively, 72.65% and 76.9% of cattle in Sylhet and Sirajgonj districts of Bangladesh were infected with different helminth parasites (Paul *et al*., 2016; Aktaruzzaman *et al*., 2013). The causes of variation in the prevalence of GI helminths infection may plausibly be due to different geographical regions, methods of sample examinations, selection, farm management system, herd and husbandry practices of cattle.

In this study, eggs of six genera of GI helminths parasites and two protozoa parasites were identified. The present findings of this study are in accordance with the findings are reported previously at Netrakona and Mymensingh districts where 6 to 9 species of helminth parasites including protozoa were recorded (Hye, 2015; Siddiqua, 2020).

Among the identified eggs of GI parasites, three genera were trematodes, namely, *Paramphistomum* spp. (40%), *F. gigantica (*16%), *Schistosoma* spp. (28%), three genera of nematodes *viz*. stomach worm (30%) and *Oesophagostomum* spp. (10%) and single genera of cestodes, *Moniezia* spp. (20%) and two genera of protozoa, namely, *Eimeria* spp. (26%) and *Balantidium coli* (38%), respectively. In this study, *Paramphistomum* spp. infections had highest prevalence while *Oesophagostomum* spp. infections had lowest. These results are in agreement with the earlier findings reported from different parts of the country (Ashrafuzzaman, 2012; Yasin, 2012; Alam, 2010). The variations in the prevalence of different GI parasite infections with the earlier reports might be due to the various sample size selection, age, sex, breed, period and place of study and availability of the vector snail in the Sirajganj region. Moreover, the change in the climatic condition over the decades, introduction of irrigation systems, development of inland fisheries, easy movement of animals from distant places and the management practice might have important roles in variation of the findings.

The prevalence of GI parasitic infections was significantly higher in both calves and young cattle compared to that of adult. Recently, a similar results in Gampaha of Sri Lanka was reported where high prevalence of GI parasites was determined in the calves aged ≤ 12 months (Gunathilaka *et al*., 2018). The higher prevalence of Nematode infection in calf was supported by the reports of Bachal *et al*. (2002) who recorded such infection in early months of life. However, the causes for variations in the prevalence of parasites at different age groups are difficult to explain, but they might be due to an immunological status of the animals, difference in the grazing area, and management conditions of cattle (Regassa *et al*., 2006).

In this study, it was found that the prevalence of GI parasite infections was significantly higher in female animals than in male animals. Variation in occurrence of GI parasite infections in male and female animals might be due to lowered resistance of female animals or temporary loss of acquired immunity near parturition, stress, genetic resistance of host and insufficient feed supply against their higher needs (Raza *et al*., 2010).

Breed of the cattle had an effect on the prevalence of GI helminths infection. In this study, the prevalence of GI parasite infections was greater in crossbreeds of cattle. The current findings are consistent with earlier studies in the country, where cross-bred cattle have more parasite infections than indigenous cattle (Karim *et al*., 2019; Alim *et al*., 2012; Paul *et al*., 2016). However, the hot-humid environment of Bangladesh favors the reproduction and multiplication of various parasites. For this reason, crossbred animals may become readily infected by parasites (Karim *et al*., 2019).

The poor and medium BCS animals were more likely to be susceptible to GI parasitic infections than the healthy cattle. The earlier observations made in various parts of the country are consistent with the findings of this study (Karim *et al*., 2019; Ilyas *et al*., 2016). Malnutrition and other concurrent parasitic infections to the host may result in a weak immune response to the infective stage of parasites, which may impede feed intake and nutrient utilization, worsening the body condition of the animals, causing stunted growth, and reducing the production of the livestock industry. Additionally, it has been noted that immunosuppressed and malnourished animals had higher parasite fecundity. The vulnerability of animals to internal parasites and their low immunity may be the causes of the severity of GI parasitic diseases (Gunathilaka *et al*., 2018). In this study, significantly higher prevalence was observed in pregnant and lactating animals than non-pregnant animals. Major hormonal and nutritional changes occur during pregnancy, thus, making the individual susceptible to helminth infections around parturition (Mpairwe *et al*., 2014).

In conclusion, age, sex, breed, BCS and physiology of the animals were identified as the risk factors of GI parasitic infections in cattle of Sirajganj, Bangladesh. In order to limit the build-up of parasitic infections, adoption of hygienic practices during feeding and housing of animals in conjunction with routine use of anthelmintic drugs are recommended.

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NOVELTY STATEMENT

This study has highlighted the high prevalence, intensity and risk factors of gastrointestinal (GI) parasite infections in cattle of Sirajganj, Bangladesh.

AUTHOR'S CONTRIBUTION

MZA received the research grant. MZA and KZ were involved in designing the present study and collection of data. KZ and NNS performed laboratory experiments. KZ and ARD conducted data analyses. MZA and ARD interpreted the data. SA, BCK and SAR wrote the draft of the manuscript. All authors checked and approved the final manuscript.

Ethics statement

The research protocol was reviewed and approved by the Research Ethics Committee of The Faculty of Veterinary Science, Bangladesh Agricultural University. While carrying out this research, no animals were harmed or unethically injured/ killed.

Declaration

The work has not been published previously or not under consideration for publication elsewhere. The article is approved by all authors.

Generative AI and AI assisted technology statement

The authors declare that no generative AI and AI assisted technology was used in the creation of this manuscript.

Conflict of interest

The authors have declared no conflict of interest.

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