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RESEARCH ARTICLE
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Concurrent infection and seasonal distribution of gastrointestinal parasites in cross-bred cattle of Sirajganj district in Bangladesh

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Abstract

Aim: To determine the extent of concurrent infection and seasonal distribution of gastrointestinal parasites in cross-bred cattle of Shahzadpur upazila of Sirajganj district, Bangladesh.

Materials and Methods: Faecal samples from 4248 cross-bred cattle presented to the diagnostic centre of Milk Vita, Baghabari, Sirajganj with complains of digestive disturbances over the period from November, 2008 to October, 2009 were examined grossly with naked eye followed by microscopic examination with direct smear method, Will's floatation and sedimentation techniques.

Results: Out of 4248 faecal samples examined, 3268 (76.93%) samples harboured one or more parasitic ova or cyst and the rest 980 (23.07%) samples found free of parasitic ova or cyst. Among the positive cases, single infection of fascioliasis (29.0.5%), paramphistomiasis (8.3%), toxocariasis (11.32%), haemonchosis (2.47%), monieziasis (0.7%), balantidiasis (4.19%), trichuriasis (1.1%), trichostrongylosis (1.4%) and strongyloidosis (1.6%) were diagnosed. Mixed infection with at least two (dual infection) and/ or any three of above mentioned parasitic species (triple infection) were also recorded. Cattle harbouring eggs of one parasite were more common [60.03% (95% Confidence interval (CI): 58.53, 61.51)] than those harbouring eggs of two [15.44% (95% CI, 14.36, 16.56)] or three [1.46% (95% CI, 1.12, 1.87)] parasites concurrently. Significantly ($p<0.001$) higher proportion of fascioliasis cases observed in rainy season compared to those in winter and summer season, similar trends were also noticed in case of paramphistomiasis, toxocariasis and balantidiasis. An increasing trend of occurrence from summer through rainy and winter season was observed in case of haemonchosis, monieziasis, trichuriasis and strongyloidosis but not statistically significant ($p>0.05$). A non-significant ($p>0.005$) decreasing trend of occurrence from winter through summer and rainy season was also observed in case of trichostrongylosis.

Conclusion: The result of current study clearly indicate that helminth infections are highly prevalent in cross-bred cattle of the study area. The findings on abundance and distribution of gastrointestinal parasitism in different age groups of cattle, the poly-parasitism nature of the disease and the seasonal variation of occurrence obtained from present study will therefore assist the clinicians for forecasting of parasitism and make awareness among the farmers to take appropriate control measures against them.

Keywords: concurrent infection, cross-bred cattle, gastrointestinal parasitism, seasonal distribution.

Introduction

The gastrointestinal tract (GIT) of animal harbours variety of parasites particularly helminthes and ciliates which cause clinical and sub clinical parasitism. Gastrointestinal parasitism is the most important diseases encountered by livestock sector of Bangladesh and thought to be one of the major constraints in development of dairy cattle worldwide [1, 2]. Gastrointestinal parasites not only affect the health of cattle but also affect the productive and reproductive performance, loss in body weight, digestive disturbances, and emaciation for longer period [3, 4]. In dairy cows, parasitic infections reduce milk yield between 1.2 and 2.2 kg milk/cow/day [5]. Infections also negatively impact carcass quality and reproductive performance including calving rate and calf mortality [6]. Report revealed that 50% calves up to 1 year of age died due to gastrointestinal parasitism in Bangladesh [7]. Potential economic loss resulting from gastrointestinal (GI) nematode infections is clearly recognized by producers and veterinarians, as evidenced by the fact that approximately 99% of feedlots and 69% of dairies use a parasiticide in their operations [8]. GI parasitosis is neglected in many cases, as most of the parasitic infections are subclinical. It is reported that at least two third of the total livestock population of Bangladesh are infected subclinically with parasitic helminth parasites [9]. Subclinical diseases are often ignored resulting in heavy economic loss. The economic losses due to subclinical problems in the livestock population are significantly higher than clinical problems in individual animals [10].

The extent of infection and co-infection of gastrointestinal parasites varies depending upon

different intrinsic and extrinsic epidemiological and biological factors. It differs greatly from one year to the next and between geographical locations depending on the prevailing climatic conditions [11]. Moreover, stress, poor nutrition and concurrent disease may be associated with the release of hypobiotic larvae from the dormant state leading to clinical helminthosis. The geological condition together with the water logged and low lying areas in Bangladesh, poor husbandry methods and chronic shortage of nutrients predispose to rapid multiplication and dissemination of parasites [12, 13].

Shahzadpur upazila of Sirajganj district is considered as one of the milk pockets of Bangladesh because of its milk production strength, where dairy sector is expanding in a noticeable way over the last three decades. Milk vita, the brand name of Bangladesh Milk Producer's Cooperative Union Limited, organized farmers of the study area who experienced cattle rearing in semi-extensive and intensive management system and received free veterinary consultancy such as deworming in a regular basis. In such setting, it is essential to assess the status of GI parasitism even after regular treatment. Only a limited inland literature is available on single gastrointestinal parasitism in cattle while the multiple parasitic infections were overlooked in previous reports [12, 13, 14]. Hence, the present study was undertaken to investigate the severity of gastrointestinal parasitism of cattle and their seasonal distribution pattern in the study area.

Materials and Methods

Ethical issues: Prior consent was obtained from the owner of cattle from which fecal samples were collected for this study. Care was taken to avoid accidental injury to the cattle during per rectum fecal sampling.

Origin of study population: The study cattle population was originated through Shahzadpur upazila of Sirajganj district (Fig.1). The annual average temperature of this area reaches a maximum of 34.6 °C, with a minimum of 11.9 °C and receives rainfall from June to September with mean annual rainfall is 1610 mm (63.4 in).

Study subjects: Cross-bred cattle, clinically sick with different digestive disorders, were the study subject. In Bhagabari area, cattle management system practiced in two distinguished methods depending on availability of pasture land. During the rainy season (July to October) when pasture land goes under water, cattle are kept in intensive management system, fed on concentrates and hay. During dry-winter season (November to June) cattle are reared in a semi-intensive system popularly termed as "Bathan." In this system animals are kept in the pasture encircled by bamboo fence. Concentrate supplement and water are provided during milking once daily.

Study design: It was a retrospective study conducted on 4248 cross-bred cattle presented to the diagnostic centre of Milk Vita, Baghabari, Sirajganj with complains of digestive disturbances over the period from November, 2008 to October, 2009. Number of cases was recorded based on the date of intervention, species and age of animals.

Faecal sample of each animal was collected directly from the rectum in polythene bags and was examined immediately after collection grossly with naked eye for different worms followed by microscopic examination with direct smear method, Will's floatation and sedimentation techniques. Positive cases were diagnosed based on the characteristic morphological features of egg of helminth parasites and cyst of protozoal parasites [15]. In this study, only gastrointestinal helminth and protozoal parasites were considered. At least three slides were examined before declaring a case negative. The results of faecal sample examination were then recorded according to age, seasons and sex of animals. Three seasons namely summer (March to June), rainy (July to October) and winter season (November to February) were considered.

Statistical analysis: The data were entered and managed in MS Excel work sheet (MS Office 2010). Proportion of different parasitism was expressed as percentage by dividing the total number of cattle positive to a specific parasitic egg or cyst to the total number of cattle examined. The exact binomial 95 % confidence intervals (CI) of proportion and the Z-test for proportions were performed to find out the significances in the proportion of different parasitism in three seasons and the proportion of single, dual or triple infection by using STATA-12 [16]. Statistical significance was considered up to 5% ($p<0.05$) level.

Results

Concurrent infection of gastrointestinal parasites: Out of 4248 faecal samples examined, 3268 (76.93%) samples harbored one or more parasitic ova/ cyst and the rest 980 (23.07%) samples were found free of parasitic ova/ cyst. The proportion of single parasitic infection [60.03% (95% CI, 58.53, 61.51)] was significantly higher than those of dual [15.44% (95% CI, 14.36, 16.56)] and triple infection [1.46% (95% CI, 1.12, 1.87)] (Fig. 2).

Single infections of GI endo-parasites during the study were fascioliasis, paramphistomiasis, toxocariasis, haemonchosis, monieziasis, balantidiasis, trichuriasis, trichostrongylosis and strongyloidosis. Dual infection comprised of fourteen different pairs of the above mentioned parasites and triple infection included sixteen different combinations taking at least three of aforesaid parasites concurrently (Table-1).

Among the single infection, the highest frequency was recorded for fascioliasis (29.05%) where monieziasis (0.7%) was the least frequent one. Among the dual infection, fascioliasis with balantidiasis [3.55% (95% CI, 3.02, 4.16)] had the highest frequency

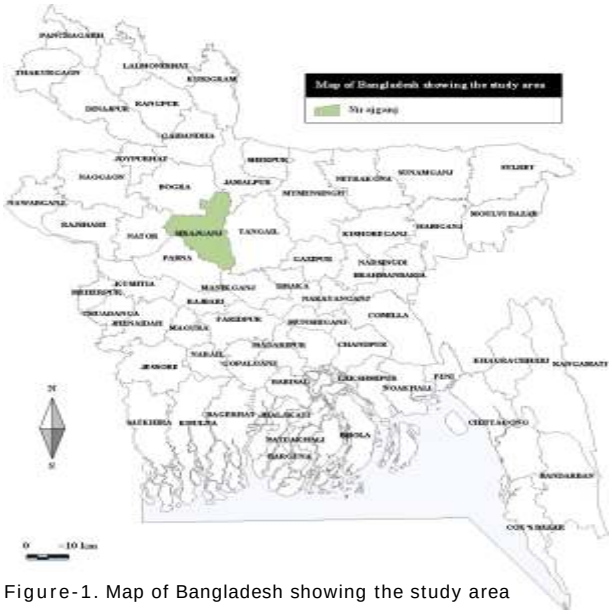

Figure-1. Map of Bangladesh showing the study area

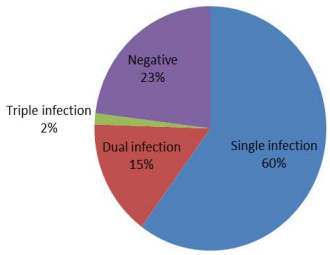

Figure-2. Proportion of gastrointestinal parasitism in cross-bred cattle at Sirajganj

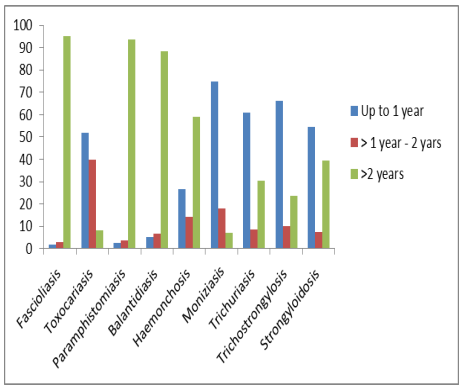

Figure-3. Age related proportion of gastrointestinal parasitism in cross-bred cattle at Sirajganj

Table-1. Overall proportion of gastrointestinal parasitism in cross-bred cattle at Sirajganj

Parasitosis	No. of positive cases (N=4248)	Proportion (95% CI*)
Fascioliasis (F)	1234	29.05% (27.7, 29.14)
Toxocariasis (Tx)	481	11.32% (10.4, 12.31)
Paramphistomiasis (P)	353	8.31 % (7.52, 9.18)
Balantidiasis (B)	178	4.19 % (3.36, 4.48)
Haemonchosis (H)	105	2.47 % (2.05, 2.98)
Monieziasis (M)	28	0.7 % (0.5, 1)
Trichuriasis (T)	46	1.1 % (1, 1.4)
Trichostrongylosis (Ts)	59	1.4 % (1.1, 1.8)
Strongyloidosis (S)	66	1.6 % (1.2, 2)
Sub-total (**single infection**)	**2550**	**[a]60.28 % (58.53, 61.51)**
F + B	151	3.55 % (3.02, 4.16)
P + B	85	2.0 % (1.6, 2.47)
F + H	78	1.8 % (1.4, 2.3)
F + S	71	1.7 % (1.3, 2.1)
F + Ts	43	1 % (0.8, 1.4)
P + Ts	9	0.2 % (0.1, 0.4)
P + H	24	0.6 % (0.4, 0.8)
F + M	10	0.24 % (0.13, 0.43)
F + Tx	32	0.75 % (0.52, 1.06)
F + P	69	1.62 % (1.27, 2.05)
P + Tx	31	0.73 % (0.5, 1.03)
B + Tx	35	0.8 % (0.6, 1.1)
H + S	4	0.1 % (0.04, 0.2)
Ts + S	14	0.3 % (0.2, 0.6)
Sub-total (**dual infection**)	**656**	**[b]15.44 % (14.36, 16.56)**
F + H + Tx	2	0.05 % (0.01, 0.2)
F + M + H	3	0.07 % (0.02, 0.2)
F + B + H	14	0.3 % (0.2, 0.6)
P + S + Tx	2	0.05 % (0.01, 0.2)
F + S + H	6	0.14 % (0.005, 0.31)
F + B + Ts	1	0.02 % (0, 0.13)
F + P + Tx	5	0.12 % (0.05, 0.3)
F + Tx + S	5	0.12 % (0.05, 0.3)
F + Tx + B	2	0.05 % (0.01, 0.2)
F + P + S	6	0.14 % (0.005, 0.31)
F + P + Ts	2	0.05 % (0.01, 0.2)
P + Ts + H	3	0.07 % (0.02, 0.2)
H + B + S	5	0.12 % (0.05, 0.3)
F + Tx + Ts	1	0.02 % (0, 0.13)
Tx + B + H	1	0.02 % (0, 0.13)
Tx + S + Ts	1	0.02 % (0, 0.13)
Sub-total (**triple infection**)	**62**	**[c]1.46 % (1.12, 1.87)**

*CI= Confidence interval; Values with different letters (a,b,c) in superscript within the last column differ significantly ($p<0.001$)

and haemonchosis with strongyloidosis [0.1% (95% CI, 0.04, 0.2)] was the lowest.

The proportion of infection causes by different parasitic species varied in different age groups of cattle. The proportion of fascioliasis, paramphistomiasis, balantidiasis and haemonchosis were higher in the group of more than two years in comparison to other age groups. The proportion of toxocariasis, monieziasis, trichuriasis, trichostrongylosis and strongyloidosis were relatively higher in younger cattle (up to 1 year of age) than those in older age groups (>1 year to 2 years and > 2years of age) (Fig. 3). Concurrent infection with two or three parasites is higher in cattle of older age group compared with younger one.

Seasonal distribution of gastrointestinal parasitism: The overall proportion of gastrointestinal parasitism caused by single parasite is significantly higher in rainy season than those in summer season. Significantly higher proportion of fascioliasis was observed in rainy season than that in winter and summer seasons. Similar trend was also noticed in case of paramphistomiasis, toxocariasis and balantidiasis. An increasing trend of occurrence from summer through rainy and winter season was observed in case of haemonchosis, monieziasis, trichuriasis and strongyloidosis which are insignificant statistically. An insignificant decreasing trend of occurrence from winter through summer and rainy season was observed in case of trichostrongylosis (Table-2).

In this study, the proportion of dual parasitic infection is higher in rainy season compared with those in winter and summer season but statistically

Table-2. Seasonal distribution of different gastrointestinal parasitism in cattle in Sirajganj

Parasitosis	**Summer** (n=1289) Proportion (95% CI*)	**Rainy** (n=1766) Proportion (95% CI*)	**Winter** (n=1193) Proportion (95% CI*)
Fascioliasis	[a]22.3%(19.91,24.63)	[b]43.6%(40.81,46.42)	[a]34.19%(31.55,36.92)
Paramphistomiasis	[a]24.09%(19.71,28.89)	[b]46.74%(41.44,52.1)	[a]29.18%(24.49,34.22)
Toxocariasis	[a]27.44%(23.5,31.67)	[b]42.2%(37.75,46.76)	[a]30.35%(26.27,34.68)
Balantidiasis	[a]27.53%(21.11,31.71)	[b]39.32%(32.1,46.91)	33.14%(26.28,40.58)
Haemonchosis	47.62%(37.78,57.6)	33.33%(24.43,43.2)	17.14%(10.49,25.73)
Monieziasis	25%(10.7,44.9)	35.71%(18.64,55.93)	39.29%(21.5,59.42)
Trichuriasis	15.21%(6.34,28.870	32.61%(19.53,48.02)	52.17%(36.95,67.11)
Trichostrongylosis	25.42%(14.98,38.44)	23.73%(13.62,36.59)	33.9%(22.08,47.39)
Strongyloidosis	25.75%(15.78,38.01)	37.88%(26.22,50.66)	34.89%(23.53,47.58)
Overall	[a]30.34%(28.96,31.75)	[b]41.57%(40.08,43.07)	28.1%(26.73,29.46)

*CI = Confidence interval; Values with different letters (a,b) in superscript within the last column differ significantly ($p<0.001$)

insignificant and the proportion of concurrent infection with three parasites is higher in winter season than those in rainy and summer seasons.

Discussion

Proportion of gastrointestinal parasitism over the study population clearly indicated heavy parasitic burden leaded by fascioliosis. Higher prevalence of parasitosis might be due to frequent exposure to the same communal grazing land that causes contamination of the pasture. The pasture in the study area remains submerged for four months but the remaining 8 months cattle graze there. Initially the pasture may remain clean for nematode larvae but probably infected with encysted metacercaria of trematodes. These metacercaria may remain viable for up to 6 months [17]. As the pre-patent periods of most nematodes are shorter (less than a month) gradual buildup of infective stage of nematode in pasture is possible. However, cattle of the study area are routinely (biannually) treated with broad spectrum anthelmintics. Inappropriate dose, ineffective drugs and development of anthelmintic resistance may be responsible for such a high level of GI parasitism in this area even after regular treatment. Variation in the load of different species of gastrointestinal parasitic infections might be due to geo-climatic conditions, breed, age, sex, plane of nutrition, stress, availability of intermediate host [18]. In present research, sampling population was female (dairy cows and female claves) dominated and only very few number calves were male. Adult cattle were found to be vulnerable for GI parasitism compared to that of young. It might be due to keeping them for a longer period of time in breeding and milk production purposes or supply inadequate feed against their high demand [19].

The proportions of most of the gastrointestinal parasitism were higher in rainy season which was in close agreement with earlier reports [14, 20, 21]. It may be explained as adequate moisture and optimum temperature which favoured the growth and survival of infective stages of nematodes leading to more contamination of the pasture or feed [1, 3, 22] and availability of snail host for paramphistomiasis and fascioliasis. On the other hand, subsequent occurrences of gastrointestinal parasitic infections were observed in winter followed by summer season which showed consistency with the previous observations [12, 21, 22]. It might be due to hot humid climate in summer and low temperature in winter season provides unfavourable environment for the survival and development of parasitic larvae [23] which decreased the availability of infective larvae in the pasture [24]. The proportion of haemonchosis found in summer season is consistent with the reports of [23] who reported that relatively high temperature and humidity in the microclimate required for the larval development and survival.

Conclusion

The result of current study clearly indicated that helminth infections are highly prevalent in cross-bred cattle of the study area. It also demonstrated the abundance and distribution of gastrointestinal parasitism in different age groups of cattle, the poly-parasitism nature of the disease and the seasonal variation of occurrence. The findings of current study will therefore assist the clinicians regarding epidemiological forecasting of parasitism and aware the farmers to take appropriate control measures against them. The higher prevalence of helminth infection in such setting demands the determination of efficacy and/ or resistance pattern of anthelmintics commonly practiced over there.

Authors' contributions

MA and MGY did the sampling and laboratory works. MAI did the statistical analysis. SAR drafted the manuscript. AKMAR designed and approved the study plan and critically reviewed the manuscript. All authors read and approved the final manuscript.

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Competing interests

The authors declare that they have no competing interests.

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