Risk factor analysis of fascioliasis in two geo-climatic regions of Bangladesh

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ABSTRACT The study was conducted in two selected geo-climatic regions (Rajshahi and Chittagong) of Bangladesh to analyze the risk factors associated with fascioliasis in cattle. In total, 64 animals were randomly selected from two places. Among them, 22 cattle in Rajshahi and 14 cattle in Chittagong were found infested with fascioliasis by coprological examination. The study showed that fascioliosis was associated with several demographic (sex, age and breed), environmental (grazing area) and management factors (farming system and nutritional status). Significant association was observed between fascioliasis and various risk factors with male cattle were at high risk than female cattle. It also revealed that variables such as mixed farming, nutritional status of animal and grazing land play crucial role in infestation of fascioliasis in both the regions with the exception of breed which was significantly associated with Fasciola infection only in Chittagong district.

INTRODUCTION

Fascioliasis is an economically important parasitic disease of herbivorous mammals caused by trematodes of the genus *Fasciola* that migrate in the hepatic parenchyma and establish in the bile ducts (Troncy, 1989). Infection to host animals usually takes place with *Fasciola* metacercariae by ingesting contaminated vegetation near to or within wet grazing land. Bangladesh has a tropical monsoon climate characterized by wide seasonal variations in rainfall, high temperatures, and humidity. The geoclimatic conditions of Bangladesh are highly favorable for the growth and multiplication of parasites. Due to the tropical climate, the causal agent *Fasciola gigantica* is prevalent in this part of the world (Amin & Samad 1988; Islam & Samad 1989). The prevalence of fascioliasis may differ in cattle. Earlier reports suggest around 19-53% prevalence of fascioliasis in cattle in various districts of Bangladesh (Rahman & Mondal 1983; Chowdhury et al., 1994; Affroze et al., 2013). The prevalence of *Fasciola* infection depends on several risk factors related to the biology of the host, biology of the parasite and the management of flocks and herds. It also relates with the availability of intermediate host snail *(Lymnea auricularia)*, temperature, moisture, season, health status of animal, availability of flooded area or irrigated land which is used as grazing field of animal (Anne and Gary, 2006). The Rajshahi district, located north-west of Bangladesh, is relatively high and cannot hold waters during monsoon (Wikipedia, 2014). The Chittagong district is also a hilly area with heavy rainfall during monsoon which is located in the south-east part of Bangladesh (Wikipedia, 2015). This study was therefore carried out to analyze the risk factors associated with fascioliasis in cattle in the two selected areas of Rajshahi and Chittagong districts, Bangladesh.

MATERIALS AND METHODS

Study area and sample size

This study was conducted in Thana Veterinary Hospital, Boalia, Rajshahi and Patia Thana, Chittagong, Bangladesh. The sample size was determined by the following formula (Cannon & Roe, 1982): $n = [l-(1-a)\ 1/D]\ [(N-(D-l)/2]$, where, n= required sample size, N= population size, D= number of diseased animals, a = desired confidence interval. By this formula, a population that contains 10000 animals with 10% expected prevalence of fascioliasis; the range of calculated minimum required sample size in 95% confidence interval was 29-44. Therefore, in this study at least 30 cattle from each region were tested for Fasciola infestation.

Sample and data collection, examination of eggs

Fresh faecal samples were collected from rectum of cattle and tested in the laboratory by standard direct smear technique as described previously (Soulsby, 1983) for the detection of Fasciola eggs. The eggs of Fasciola were identified according to the key described by Thienpont et al. (1986). During sample collection, all the related data were recorded in a pre-set questionnaire. The risk factors are categorized as: (1) demographic variables, such as age, sex and breed (2) management factors, such as mixed farming and malnutrition and (3) environmental factors, such as grazing on low lying areas and grazing on highland pastures. Age of the cattle was determined on the basis of owner's information and also by dentition (Delahunt & Habel, 1986; Pace & Wakeman, 2003).

Statistical analysis

Data generated from the study was entered and managed in MS Excel work sheet and analysis was conducted using Minitab version 16. All data were subjected to Chi2/F test to determine the statistically significant (at p<0.05 with 95% confidence interval) association between various variables and bovine fascioliasis (Thrusfield, 2005).

RESULTS AND DISCUSSION

Table 1 represents the coprological prevalence of fascioliasis in the two selected areas of Rajshahi and Chittagong district. Among the tested 64 animals, 22 animals in Rajshahi and 14 animals in Chittagong were found infested with *Fasciola*. The overall prevalence of fascioliasis in Rajshahi and Chittagong district was 64.71% and 46.67%, respectively (Table 1).

Table 2 shows the measures of association between fascioliasis and different demographic, management and environmental variables. Among the affected animals, 2-3 years age group was highly susceptible to infection than other two age groups in both Rajshahi and Chittagong (Table 2). The infestation rate was comparatively lower at 3-4 years in both places, perhaps due to buildup of active immunity. However, this measure of association was not statistically significant (p>0.05) (Table

2). This observation was in agreement with the previous report of Rahman and Mondal (1983) in which high *Fasciola* infection was found in cattle of 2-3 years of age. However, Affroze et al. (2013) reported that cattle over 4 years of age had the highest prevalence of fascioliasis in Netrokona district of Bangladesh.

In the sex variable, males were significantly ($p<0.05$) highly infested with fascioliasis than females in both Rajshahi and Chittagong (Table 2). **Table 3 shows the strength of association between fascioliasis and various variables.** The strength of association between sex and fascioliasis revealed that male cattle were 6.30 and 5.21 times more susceptible than female cattle in Rajshahi and Chittagong, respectively, and these were also highly significant (Table 3). High infection in males could be due to the fact that females stay longer in the herd (during lactation period and reproduction) than males and hence, males get more exposure of parasites then the females. This finding does not support the findings of Affroze et al. (2013) and Khan et al. (2009) who recorded a higher *Fasciola* infection in females than males. However, there was no significant difference in the rate of *Fasciola* infection between male and female cattle in some previous reports (Ibrahim, 2004; Tsegaye et al., 2012).

In Rajshahi, local breeds were more infested than crossbred whereas it was not the case in Chittagong and statistically significant association ($p<0.05$) was observed between fascioliasis and breed in Chittagong but not in Rajshahi ($p>0.05$) (Table 2). The strength of association between breed and fascioliasis revealed that the crossbred cattle were 4.32 times more susceptible than the local cattle in Chittagong but crossbred cattle were less susceptible than local breeds in Rajshahi (Table 3). Tsegaye et al. (2012) found higher prevalence of fascioliasis in local breeds than in crossbred cattle. The variation between breeds could be due to differences in the management practices of the farmers in two regions.

In both Rajshahi and Chittagong, higher infection occurred in animals reared on mixed farming system than those reared on single farming system in two places, though this was not statistically significant ($p>0.05$) (Table 2). Khan et al. (2009) observed that mixed farming system can cause higher rate of infestation

of fascioliasis. Mix farming system may sometimes force animals to graze in swampy areas and thus exposing them to vegetation heavily infected with metacercariae of *Fasciola* (Soulsby, 1983).

Healthy animals were infested at higher rate than the malnourished animals in both Rajshahi and Chittagong (Table 2) and this measures of association was statistically significant ($p<0.05$). The chance of infestation was 4.76 and 2.58 times higher in the groups of malnourished animals than the healthy groups of animals (Table 3), which were also found statistically significant ($p<0.05$). This observation is supported by Mebrahtu and Beka (2013) who reported that cattle with medium BCS (body condition score) have had high susceptibility to fascioliasis.

Grazing on low lying areas is an important predisposing cause of *Fasciola* infestation. Among the affected animals, 72.73% and 64.29% cattle were found infested in Rajshahi and Chittagong, respectively, while grazed on low land areas. This variable was significantly associated ($p<0.05$) with *Fasciola* infection (Table 2). The chance of infestation was significantly higher (5.33 and 6.45 times) in low land grazing areas than those in high land grazing areas in two districts (Table 3). It is probably because abundant exposure of *Fasciola* metacercariae during grazing on low lying areas. This observation is in agreement with the reports of Mzembe and Chaudhry (1979), Chartier et al. (1990) and Tembely et al. (1995).

CONCLUSION

In conclusion, it can be stated that though the overall prevalence of fascioliasis was high in Chittagong district, there were similar associations between fascioliasis and various risk factors in the two geo-climatic regions of Bangladesh as revealed by the statistical analysis.

Table 1. Coprological prevalence of fascioliasis in cattle in two study places.

Region	No. of animals tested	Infested with fascioliasis	Prevalence (%)
Rajshahi	34	22	64.71
Chittagong	30	14	46.67
Total	64	36	56.25

Table 2. Measures of association between fascioliasis and different demographic, management and environmental exposure variables.

		Rajshahi (n= 22)		Chittagong (n= 14)	
Variables	**Category**	**% of Infestation**	**F/ Chi² value (p value)**	**% of Infestation**	**F/ Chi² value (p value)**
Demographic					
Age	1-2 years	36.36 (8)	F= 1.000 (0.98)	28.57 (04)	F= 2.603 (0.79)
	2-3 years	40.91 (9)		50.00 (07)	
	3-4 years	22.73 (5)		21.43 (03)	
Sex	Female	18.18 (9)	F= 1.000 (0.01*)	28.57 (04)	F= 1.000 (0.01*)
	Male	81.82 (13)		71.43 (10)	
Breed	Local	54.54 (12)	Chi²= 0.390 (0.64)	35.71 (05)	Chi²= 2.470 (0.001*)
	Crossbred	45.45 (10)		64.29 (09)	
Management					
Farming system	Single	45.45 (10)	F= 2.046 (0.65)	42.86 (06)	F= 3.134 (0.83)
	Mixed	54.55 (12)		57.14 (08)	
Nutritional status	Malnourished	77.27 (17)	Chi²= 4.310 (0.04*)	78.57 (11)	Chi²= 5.421 (0.03*)
	Healthy	22.73 (05)		21.43 (03)	
Environmental					
Grazing area	Highland	27.27 (8)	F= 0.036 (0.02*)	35.71 (05)	F= 0.054 (0.01*)
	Lowland	72.73 (14)		64.29 (09)	

*(Significant at $p<0.05$)

Table 3. Strength of association between fascioliasis and related risk factors (at 95% confidence interval).

Variables	Category	Rajshahi		Chittagong	
		Odds Ratio	Chi² value (p value)	Odds Ratio	Chi² value (p value)
Sex	Female	1		1	
	Male	6.30	4.37 (0.03*)	5.21	5.61 (0.02*)
Breed	Local	1		1	
	Crossbred	0.43	2.69 (0.07)	4.32	4.58 (0.01*)
Nutritional status	Malnourished	1		1	
	Healthy	4.76	6.12 (0.04*)	2.58	5.84 (0.03*)
Grazing area	Highland	1		1	
	Lowland	5.33	5.47 (0.01*)	6.45	4.72 (0.04*)

*(Significant at p<0.05)

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