

2 **Coprological, abattoir survey and economic significance of bovine**
3 **fascioliasis at Sylhet region of Bangladesh**

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6 **ABSTRACT – if possible give aim/objective, location, duration, statistical analysis**
7 **method, result and conclusion**

8 This study was conducted in the Sylhet division of Bangladesh to determine the prevalence of
9 fascioliasis in cattle of different age groups, sex and in seasons as well as to assess risk
10 factors and economic loss caused by this parasite. In this study, feces and livers of male and
11 female animals were collected randomly from different farms and slaughter house
12 respectively during a period of one year (September 2016 to August 2017). A total of 613
13 feces and 215 livers were examined of which 119 (19.41%) and 52(24.18%) were found to
14 contain *Fasciola gigantica* respectively. Fasciola in feces and liver samples were observed
15 significantly higher in older animals of above 5 years estimating 25.64% and 36.36%,
16 respectively. The lowest prevalence of feces samples was found in cattle of >3years of age
17 (10.27%) and the animals aged between 3-5years (20.00%) in case of liver sample. The
18 prevalence was higher in females contributing 19.42% in feces and 26.66% liver samples.
19 Among three seasons, infection was found to be more during rainy season 23.66% and
20 33.03% in feces and liver sample respectively. The present study indicates that fasciola
21 infection in cattle associated with the age and sex of the animals; and seasons of the year. To
22 control the disease in this area, appropriate preventive control strategies have to be designed
23 to reduce the impact of disease on livestock production in Bangladesh.

25 **Key words:** Fascioliasis, Prevalence, Feces, Abattoir survey, Cattle.

UNDER PEER REVIEW

26 **1. INTRODUCTION – write one or two reviews for the significance of fascioliasis in**
27 **human beings with any incidences of spread and its effect**

28 Fascioliasis is globally known to be an important helminthic disease of ruminants caused by
29 the genus *fasciola* and it is one of the most neglected tropical zoonotic diseases. Among the
30 parasitic diseases, fascioliasis is most important in Bangladesh. *F. gigantica* is the most
31 important liver fluke in the tropics and temperate regions frequently reported of causing
32 ruminant's fascioliasis [1]. Usually, animals become infected by the ingestion of infected or
33 contaminated feed, water and pasture [1,4]. Infection to host animals usually takes place with
34 *fasciola* metacercariae by ingesting contaminated vegetation near to or within wet grazing
35 land [4]. The clinical signs of this disease in cattle, sheep and goat are characterized by
36 weight loss, anemia and development of bottle jaw due to hypoproteinemia; reduce
37 production, poor performance, condemnation of liver and an increased mortality [5]. Others
38 [6] expressed that the total economic losses because of fascioliasis as far as liver
39 condemnations and carcasses weight losses over the 3 years of the study were evaluated
40 16,800.4 USD. The economic losses consist of costs of anthelmintic, drenches, labor, and
41 liver condemnation at meat inspection: and losses in production due to mortality, reduction in
42 meat, milk and wool production: and reduction in growth rate, fertility and draught power [7].
43 In Bangladesh, until now there is no available report about the economic losses due to
44 fascioliasis in cattle. The estimated economic losses due to condemnation of liver were
45 5.59% which amounted to US\$ 115.44 per thousand liver of slaughtered goat [8]. The direct
46 economic impact of fascioliasis is increased condemnation of liver meat; the far more
47 harmful effects are reduced animal productivity, under-weight calf birth and mitigate the
48 growth in infected animals [9]. Berandoet *al.* [10] also reported that the parasite may cause
49 decline of production in milking cows. Earlier reports suggest around 19-53% prevalence of
50 fascioliasis in cattle in various districts of Bangladesh [11-13] . The prevalence of *fasciola*

51 infection depends on several risk factors related to the biology of the host and parasite, as
52 well as the management of flocks and herds. It also relates with the availability of
53 intermediate host snail (*Lymnaea auricularia*), temperature, moisture, seasons, health status of
54 animal, improper sanitation, and availability of flooded area or irrigated land which is used as
55 grazing field for animals [14]. Coprological examination is a usual tool to investigate
56 prevalence or diagnosis of fascioliasis. Fascioliasis has raised emerged and reported zoonosis
57 in many countries with estimation of 17 million infected people and up to 180 million at risk
58 [2]. It can be transmitted from animal to human by consumption of infected improperly
59 cooked liver. Considering the economic importance and pathological effects of liver fluke
60 infection in cattle in Sylhet region, this study was conducted to determine the prevalence, risk
61 factor assessment and economic analysis of fascioliasis in cattle relation to age, sex, and
62 seasons based on fecal and abattoir survey.

63

64 **2. MATERIALS AND METHODS – leave the space before unit**

65 **2.1 Study Area and Period**

66 The research was carried out in cattle of Sylhet region in Bangladesh. The area under lies in
67 the Sylhet division is located in north-east part of Bangladesh and between 24°32' North
68 latitude and 91° 52 East longitudes. The average maximum and minimum temperatures are
69 38°C and 7°C, respectively. The annual average rainfall is 3.334 mm and humidity is 70%.
70 The annual the average maximum and minimum temperature is 10°C and 30°C, respectively.

71

72 **2.2 Study of Animals**

73 For the purpose of current study, 613 fresh feces were collected from the cattle housed in
74 individual farmers, private and government farms in Sylhet division of Bangladesh.
75 Information regarding health history, identification, age, sex and breed of cattle were

76 recorded. The farm health problems, number of cattle and the housing were also recorded to
77 gain more information about the predisposing factors for an infection with fascioliasis. The
78 cattle were alienated into three groups: Young: <3years, Adult: 3-5 years and Old: >5years of
79 age.

80

81 **2.3 Collection of Fecal Samples**

82 Freshly voided feces or directly from rectum were collected from adult cattle and calves.
83 After collection, the sample were kept on ice and brought to the laboratory. All fecal samples
84 were collected in separate cups. To prevent potential cross contamination between fecal
85 samples, separate disposable gloves were worn for each collected sample. Fecal samples
86 collected in the field were kept refrigerated at 4°C, processed for the determination of
87 parasite within 24 hours of collection.

88

89 **2.4 Coprological Examination**

90 Each samples of 20-25 gm of feces material was collected from each animal. The samples
91 were clearly labeled with universal bottles preserved with 10% formalin and each sample was
92 clearly labeled with animal's identification (age, sex), date and place of collection. Samples
93 were packed and dispatched in cool box to avoid development of eggs and hatching.
94 Coproscopic examination was performed to detect the presence of fasciola eggs using the
95 standard sedimentation techniques [15]. The egg of fasciola were identified by a drop of
96 methylene blue solution was added to the sediment to differentiate between eggs of
97 paramphistomum species and fasciola species where eggs of fasciola species show yellowish
98 color while eggs of Paramphistomum species stain by methylene blue [15].

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102 **2.5 Collection of Liver Samples**

103 During the study year, the affected cattle liver with gall bladders were collected from regional
104 slaughter houses and examined to record the prevalence and economic significance of this
105 disease in a systematic survey.

106

107 **2.6 Pathological Examination of liver**

108 Necropsies of slaughter animals were conducted and 215 livers were checked for the
109 presence of parasites. Through palpation and incision of dilated or thickened bile ducts, gross
110 pathological lesion of each diseased liver was established and recorded. Records of numbers
111 slaughtered, source of slaughtered stock and the liver lesions were observed and condemned
112 were noted down.

113

114 **2.7 Statistical Analysis**

115 Among the male and female cattle, variations in the prevalence of fascioliasis on the basis of
116 different age groups, season, sex and their location. MSExcel 2010 and SPSS version 20 were
117 used for data entry, coding, cleaning and analysis. Data was presented using graphs and
118 tables. Prevalence was analyzed with Chi-square, ANOVA and Logistic Regression test by
119 SPSS version 20.

120

121 **3. RESULTS – add discussion to this section only**

122 Among 613 fecal samples examined, 119 (19.41%) were found infected with *Fasciola spp.* in
123 Sylhet division. Samples were examined microscopically using direct smear and standard
124 sedimentation methods. Liver samples from 215 slaughtered animals were conducted and
125 livers were checked, 52% were found positive with *Fasciola spp.* The prevalence of

126 fascioliasis was found to be associated with age, sex and season as revealed by the
 127 multivariate analysis of risk factors. Among multivariable age statistically significant in both
 128 examination which was considered to the calculated P- value was less than 0.05 that was
 129 shown in table 1.
 130

Factors	Variables	No.of Examined Animals	No.of Affected Animals	Prevalence(%)	Total Prevalence(%)	P-value	Total examined Animals
Coprological examination	Age	less than 3 years	146	15	10.27	19.41	613
		Between 3-5 years	350	74	21.14		
		More than 5 years	117	30	25.64		
	Sex	Female	484	94	19.42	19.41	1.00
		Male	129	25	19.37		
	Abattoir survey	Age	Between 3-5 years	160	32	20	24.18
More than 5 years			55	20	36.36		
Sex		Female	30	8	26.66	24.18	0.818
		Male	185	44	23.78		

131 **Table 1:** Animal-level prevalence of fascioliasis in cattle at Sylhet division of Bangladesh

132

133 **Table 2:** Seasonal prevalence of fascioliasis in cattle at Sylhet division of Bangladesh

Samples	Name of Seasons	No. of Animals Examined	No. of Affected Animals	Prevalence (%)	Total Prevalence (%)	P-value	Total examined Animals
Coprology	Summer	126	18	14.28	19.41	0.114	613
	Rainy	167	40	23.95			
	Winter	320	61	19.06			
Abattoir survey	Summer	113	22	19.46	24.18	0.156	215
	Rainy	87	27	33.03			
	Winter	15	3	20.00			

Regions	No. of Animals Examined	No. of Affected Animals	Prevalence (%)	Total Prevalence (%)	Total examined Animals
Sylhet sader	435	73	16.78		
Habiganj	58	17	29.31		
Moulvibazar	78	20	25.64	19.41	613
Sunamganj	42	9	21.42		

135 **Table 3:** Regional prevalence of fascioliasis in cattle at Sylhet division of Bangladesh

136

137 **Economic losses**

138 The total weight of 215 livers was approximately 752kg and the weight of condemned mass
 139 from 52 fascioliasis affected liver was 182 kg this was 179.21 kg of the total weight. The
 140 monetary value of 752 kg liver was calculated to be US\$ 4574.20 and the monetary value of
 141 182 kg condemned liver was US\$ 1134.66 (Table 3). Based on this, the expected monetary
 142 loss due to condemnation of liver per slaughtered cattle in the population was US\$ 6.23 and
 143 the expected monetary losses per 1000 slaughtered cattle in the population would be US\$
 144 2189.78.

145

146 **Table 4:** Economic losses due to condemnation of fascioliasis affected liver of cattle.

147

Categories	Description
Weight (kg) of 215 livers	752
Weight (kg) of the condemned part from 52 fascioliasis affected livers.	182
Percent of condemned liver tissue due to fascioliasis in the surveyed population	179.21
Market value of 215 liver that is 752 kg liver tissue	US\$ 4574.20
Market value of condemned 182 kg mass of liver	US\$ 1134.66
Expected average monetary loss due to condemnation of liver per slaughtered cattle	US\$ 6.23
Expected average monetary loss due to condemnation of liver per 1000 slaughtered cattle	US\$ 2189.78

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149

150 **4. DISCUSSION – combine this with result section**

151 In this study, coprological prevalence of fascioliasis, its epidemiology and economic
152 significance were measured in cattle in the Sylhet division of Bangladesh. The prevalence
153 found in this study was lower than the earlier findings of Rahman and Mondal [11] who
154 reported a 53% prevalence of bovine fascioliasis in Bangladesh. The rate of infection of
155 fasciola may vary in different agroclimatic conditions as observed in Pakistan by other
156 contributor [17]. Similarly, the prevalence of fascioliasis varied among various districts of
157 Bangladesh. Chowdhury *et al* [12] examined fecal samples of cattle from Savar, Dhaka,
158 Bangladesh and found 19.7% samples positive for fascioliasis. Affroze *et al* [13] recorded a
159 31.1% coprological prevalence of fascioliasis in Netrokona district, Bangladesh. The climatic
160 condition and geographic position of locality may influence the type and severity of parasitic
161 infestation in grazing animals [18]. Fascioliasis more prevalent in lowland tropical areas as
162 *Lymnea auricularia* (the intermediate host snail of Fasciola) breeds throughout the year in
163 these favorable habitats [19]. The lower infection rate found in Chittagong district was 14.8%
164 in another study [12].

165

166 Among the age group, considerably high rate of infection was found in adult cattle. This
167 result was in agreement with the earlier findings [7,18]. The highest level of infection in older
168 group i.e., above 6 years (62.62%) followed by in age groups of 4-6 years (57.28%), 2-4
169 years (42.56%) and up to 2 years (17.87%) [17]. Affroze *et al* [13] also reported that cattle
170 over 4 years of age had the highest (33.3%) prevalence of fascioliasis in Netrokona district in
171 Bangladesh. High prevalence in the adult in this study could be due to the intake of parasites
172 for longer period and their grazing habit close to water logged areas.

173

174 Between the sex groups, considerably high rate of infection was found in female. This result
175 which was in agreement with the result of other workers [8,18], they observed higher
176 prevalence in females as compared to males. This finding is also inconformity with the
177 previous results [12].

178

179 Prevalence of fascioliasis in cattle was found to be high during the rainy season. The
180 fascioliasis in cattle was high in 31.71% in winter, followed by summer (22.45%) and
181 (36.84%) rainy seasons [20]. Climate conditions, particularly rainfall, were frequently
182 associated with differences in the prevalence of fasciola infection because this was
183 suitable for intermediate hosts like snails to reproduce and to survive longer under
184 moist conditions [21]. The prevalence found in this study was lower than the earlier findings
185 [22] where out of 384 fecal and liver samples tasted, a prevalence of 43.23% and 90.88% was
186 found respectively. The lower infection rate found in goat in Sylhet division was 20.75% in
187 the study [8]. According to other researchers [23], the prevalence of liver condemnations
188 due to fascioliasis decreased from 7.37, 1.80 and 4.41% in 1999–2000 to 4.64, 1.12 and
189 2.80% in 2007–2008 for cattle, sheep and goats, respectively.

190

191 According to the study of Hassan Khoramian [24], the overall 3.28% of the livers were found
192 to be infected. For total number of sheep, goats and cattle slaughtered annually in region
193 study, it was estimated that 7505 livers were infected and total annual economic losses of
194 fascioliasis of studied animals was 41 784 USD (based on market prices in study period). Of
195 this, 23360 USD, 30240 USD and 15 400 USD were associated with the fascioliasis of sheep,
196 goats and cattle, respectively. The economic importance of fascioliasis has so far been
197 reported by estimating the loss due to condemnation of liver in affected cattle [3,25].

198

199 **5. CONCLUSION**

200 Prevalence of bovine fascioliasis at Sylhet division of Bangladesh is attributed by
201 multifactorial risk factors which comprise host, parasite and environmental effects. The
202 prevalence was significantly affected by sex, age and seasons of the year. Higher prevalence
203 of bovine fascioliasis was recorded in female cattle than male and older (>5years) than
204 younger ones. As intermediate host is endemic in high rainfall and water logged area, Sylhet
205 region is suitable for surviving the intermediate host. *Fasciola gigantica* infections in cattle
206 are endemic and widespread in Sylhet. The feces collected from animals in farm condition
207 that's why the prevalence was lower compared to free ranged animals. So, the control
208 measures should be taken by destruction of intermediate host (snail population).
209 Avoiding low lying pastures have also significantly important for controlling fluke
210 infections. Periodic anthelmintic treatment should be given to get the maximum benefits
211 from cattle. Liver condemnation due to fascioliasis had caused enormous economic income
212 loss to the meat sellers. The majority of the farmers had heard about fasciolosis but were not
213 aware of its cause and the fact that it can infects human beings proving that it has not been
214 given the attention it requires making it a neglected disease of significant public health
215 importance. Based on the research, selective and periodic use of anthelmintics in cattle
216 against liver fluke infection as treatment will reduce the treatment cost as well as losses from
217 the liver condemnation by the disease in cattle population in Bangladesh.

218

219 **CONFLICT OF INTEREST**

220 The authors declare that there is no conflicting interest with regards to the publication of this
221 manuscript.

222

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