International Journal of
Innovative Research

International Journal of Innovative Research, **8(2)**: 28–33, 2023
ISSN 2520-5919 (online)
www.irsbd.org

RESEARCH PAPER

Study on the Prevalence of Bovine Fascioliasis at Selected Areas of Gopalganj District in Bangladesh

Md. Rafiul Islam*

Bangabandhu Academy for Poverty Alleviation and Rural Development (BAPARD), Kotalipara, Gopalganj, Bangladesh

ARTICLE HISTORY

Received: May 10, 2023
Revised : June 15, 2023
Accepted: June 25, 2023
Published: August 31, 2023

*Corresponding author:
rafiul.bapard@gmail.com

ABSTRACT

A prevalence study was conducted during the period from November, 2022 to April, 2023 to determine the prevalence of bovine Fascioliasis at four unions of Kotalipara upazila under the Gopalganj district in Bangladesh through field survey and Laboratory analysis. A total of 221 faecal samples of cattle showing emaciation, diarrhea and weakness were collected from selected unions of Kotalipara upazila of Gopalganj district. Examination of the faecal samples by direct smear revealed an overall prevalence of 48.87% fascioliasis in cattle. The highest prevalence of Fascioliasis was detected in kotalipara pourashava (50.98%) followed by Hiron union (48.08%), Kushla union (47.54%) and Pinjuri union (45.61%). While considering the age, the highest prevalence of Fascioliasis was detected in the young cattle of ≥1-2 years aged group (50.43%) followed by the adult cattle of <2-4 years of age (47.83%) and the older cattle of < 4 years of age (45.71%). On the other hand, the higher prevalence of Fascioliasis was recorded in Females 51.69% compared to males 45.63%. Among the study population, the highest prevalence was recorded in cross breed (54.4%) cattle than local or indigenous (41.67%) cattle. This study suggests that Fascioliasis is endemic in cattle in study areas of Kotalipara upazila and sex and breed of the cattle are important risk factors for the prevalence of clinical Fascioliasis in cattle. The effective measures are needed for controlling this infection with a view to profitable livestock farming in the study area.

Key words: Fascioliasis, Risk factors, Prevalence, Cattle, Four unions, Kotalipara

Introduction

Fascioliasis is a parasitic disease responsible for liver disorders in ruminant hosts and leads to a reduction in livestock productivity. This disease in ruminants causes substantial economic losses to rural agricultural communities and commercial animal producers due to the death of infected animals, condemnation of affected livers and production losses associated with reduced feed conversion efficiency worldwide (Torgerson and Claxton 1999; Spithill *et al*. 1999). Bovine fasciolosis has direct economic impact in increasing condemnation of liver, but far more effects are decreased animal productivity, lower calf birth weight and reduced growth in infected animals and cost of animal treatment (Legesse *et al*. 2017). Fascioliasis is an economically important parasitic disease, which is caused by trematodes of the genus Fasciola that migrate in the hepatic parenchyma and establish and develop in the bile ducts (Troncy 1989). Fasciola is commonly recognized as liver flukes and they are responsible for wide spread of morbidity and mortality in cattle characterized by weight loss, anemia and hypoproteinemia, reduced production of meat, milk, and wool, and expenditures for anthelmintics (FAO, Rome 1994). In Bangladesh, Fascioliasis is one of the most prevalent parasitic diseases in cattle, buffaloes, goats and sheep (Nooruddin and Islam, 1996; Alim *et al* 2004; Hossain *et al* 2011). It is an emerging parasitic infection, having significant impacts on both veterinary and human health throughout the world Lazara *et al*. (2010). The development of fascioliasis involves the presence of an intermediate host (*Lymnaea sp.*), suitable habitats for mollucas and environmental factors such as high humidity, adequate temperature and rainfall. The two most important species, *Fasciola hepatica* found in temperate areas and in cooler areas of high altitude in the tropics and subtropics and *Fasciola gigantica*, which predominates in tropical areas like as Bangladesh. Generally in tropical countries when both species coexist *F. gigantica* is usually endemic in lower regions while *F. hepatica* is endemic in the high lands (Boray 1982). *Fasciola gigantica* is a fresh water snail and infection with this species is associated with livestock drinking from snails infected watering places as well as with grazing wetland. The major endemic areas for *F. gigantica* are large tropical regions of Africa and many areas of Asia including India, Pakistan and

Bangladesh (Mas, 2004). Bangladesh has a tropical monsoon climate characterized by wide seasonal variations in rainfall, high temperatures and humidity. The geo-climatic 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). Fascioliasis by *Fasciola gigantica* is distributed throughout Bangladesh including the north western semi-arid Barid tract (Rahman *et al* 2019) and the southernmost off shore Saint Martin Island (Yasin *et al* 2018). In cattle, sheep and goat, the disease also causes high economic losses from anemia, reduced production, poor performance, condemnation of liver and an increased mortality (Hammond *et. al*. 1974, Fabiyi *et al.* 1982). Apart from the reductions in milk and meat yield, it is also involved in losses due to decreased fertility (Abunna *et al.* 2010). Because of global warming there are great changes in climatic condition which is highly reflected in Bangladesh. This condition is giving more chances of development of the infective metacercariae and eventually infection in cattle and other ruminants even in the highland areas including the Barind Trcats (Rahman et al 2019). The southern and coastal zones of Bangladesh are primarily affected due to global warming and climate changes Recently, the Government of Bangladesh has taken up a project for Assessment of potential threats to the Poultry sector and Livestock sector and development of adaptive measures and dissemination among farmers. Besides this, the region is a low land area. Huge amounts of snails are found in grazing areas and rivers. Most of the farmers of this area use river's water for the drinking purpose of their cattle. Often, cattle take drinking water from grazing land. Considering all those facts, the objective of the present study was set to detect the prevalence of Fascioliasis in cattle at several unions of Kotalipara upazila of Gopalganj district in Bangladesh.

Materials and Methods

Study area, sample size and duration

This cross sectional study was conducted during the period of November, 2022 to April, 2023 at four unions (Kotalipara Pourashava, n=51; 07 no. Hiron, n=52; 06 no. kushla, n=61 and 11 no. Pinjuri union, n=57) of Kotalipara upazila under Gopalganj district (Fig 1). Kotalipara is a part of the south Coastal belt of Bangladesh. It is located between 22°.52' and 22.08' N and 89°.55' and 89°08' east latitude. Kotalipara upazila of Gopalganj district is southern area of Bangladesh and the region occupies extensive low lying areas between the Ganges river floodplain and the Ganges tidal floodplain. The low lying marshy areas in Kotalipara upazila remain water logged in most of the seasons of the year (Banglapedia 2021).

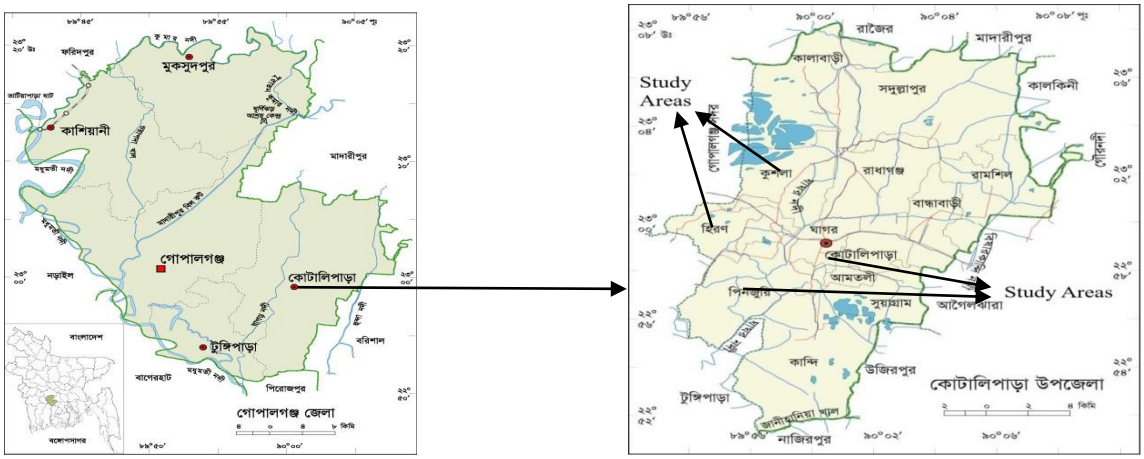

Figure 1: Study area for the prevalence of Bovine Fascioliasis

Study population were divided into three age groups i.e.Young (≥1-2 years, n=117); Adult (<2-4 years, n=69) and older (<4 years, n=35). The selected cattle were categorized into three age groups viz. young (1- 2 years, n= 114), adults (>2 years – 4 years, n= 70) and older (> 4 years, n = 46). The cattle were categorized into male (n = 103) and female (n = 118) groups to determine the influence of sex on susceptibility of cattle to Fascioliasis. To determine the influence of breed, the sampled cattle were divided into local/indigenous (n = 96) and cross-bred (n = 125). Epidemiological data (age, sex, breed etc.) was collected from the owners by cross-questioning and clinical data were recorded after physical and clinical examinations. All relevant information was taken and recorded carefully during collection of faecal samples. Faecal samples were collected from suspected cattle for confirmatory diagnosis by coprological examination. The samples were examined at BAPARD Laboratory on the day of collection.

Coprological Examination

A total of 221 numbers of cases of cattle were recorded randomly during the study period. Fecal samples were collected directly from the rectum of the cattle or immediately after defecation or from the ground when the animals were found in the act of defecation. About 15-25 grams of feces were collected from the animals. Each fecal sample was transferred to a jar and labeled properly with relevant information (age, sex, breed and area etc.). The fecal samples were examined using standard direct smear method of fecal sample examination described by Soulsby (1982) at BAPARD Laboratory on the day of collection.

Diagnosis of Fascioliasis

Tentative diagnosis was made on the basis of history, physical and clinical signs (depression, dullness, in appetite, rough hair coat, diarrhea, emaciation, bottle Jaw appearance formation). Confirmatory diagnosis was made on the basis of coprological examination findings;

Fasciola eggs were confirmed by the characteristics of oval shaped, eccentric morulla, operculum present, yellow brown in color. Presence of single eggs of *Fasciola sp. in one microscopic focus* during coprological examination was recorded as positive for fascioliasis.

Data analysis

All the data were processed, summarized and prevalence percentage was calculated by Microsoft Excel-2007 Program. A descriptive analysis was performed to interpret the data.

Results and Discussion

Overall Prevalence of Fascioliasis

A total 221 fecal samples were collected from clinically suspected cattle. Of the samples examined, 108 were found positive. The result of the present study revealed that the overall prevalence of Fascioliasis was 48.87% (108/221) (Fig 2).

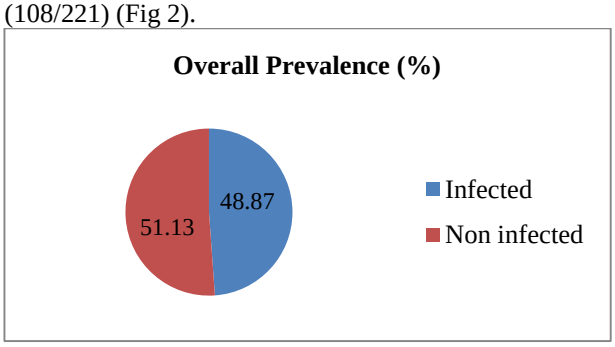

Figure 2: Overall prevalence of Fascioliasis

The findings are supported by Islam *et. al*. (2022), Howlader *et al*. (2017) Yadav *et al.* (2015) and Karim *et al.* (2015). The result of the present study was similar to the study of Yadav *et al.* (2015) who reported overall prevalence of fascioliasis in cattle is 51.0%. Abraham *et al.* (2014), is stated that the prevalence of fascioliasis is 44.8%. Karim *et al.* (2015) also found the overall prevalence of fascioliasis is 66.14%. But Sumbal Haleem *et al.* (2016) reported the overall prevalence of fascioliasis in cows was 25%. Chakraborty and Prodhan (2015) found the prevalence of fascioliasis is 14.8%, those results disagree with the present study results. The variation with the findings of the present study was very high; it might be due to location, use of anthelmintics, session and duration of the study. Prevalence of Fascioliasis in cattle is attributed by multi-factorial risk factors which comprise host, parasite and environmental effects. High rainfall areas favour development and survival of both the intermediate host snail and the developmental stages of the parasite Affroze S. *et al.* (2013). This variation might be due to the variation on sample size and sampling, nutritional status, geographical location such as grazing on low lying areas is an important predisposing cause of Fasciola infestation Khatun *et al.* (2015); Tembely *et al.* (1995).

Location base prevalence of clinical Fascioliasis

The prevalence of clinical Fascioliasis in the study areas varied from 50.98% to 45.61%. The highest infection (50.98%, 26/51) was recorded in Kotalipara Pourashava followed by Hiron union (48.08%, 25/52), Kushla union (47.54%, 29/61) and Pinjuri union (45.61%, 26/57). Comparative analysis (Fig 3) revealed that the areas were more vulnerable for Fascioliasis. The slight difference in the prevalence of GI parasitic infections might be due to variation in geo-climatic conditions or inadequate sample collection from these study areas or may be improper inspection for sampling.

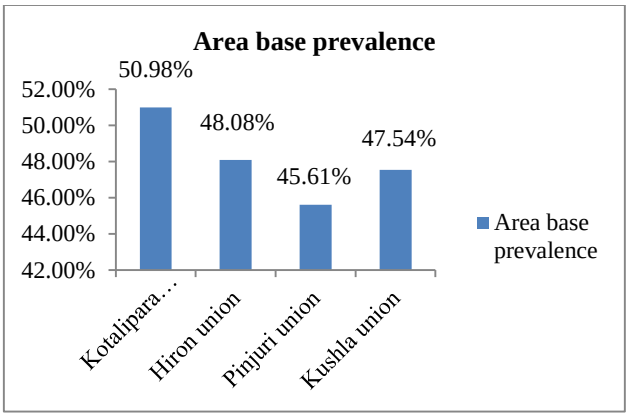

Figure 3: Area base prevalence of Bovine Fascioliasis

Clinical Fascioliasis Associated with Age

Study population of the cattle was divided into three age groups i.e. ≥1-2 years, <2-4 years and <4 years. The highest prevalence of clinical Fascioliasis was observed in the cattle group ages between ≥1-2 years (50.43 %) followed by <2-4 years (47.83%) and <4 years (45.71 %) (Table 1).

Table 1: Age wise prevalence of clinical Fascioliasis

Age group (Year)	No. of Cattle	No. of Cattle Affected	Prevalence (%)
≥1-2	117	59	50.43
<2-4	69	33	47.83
<4	35	16	45.71
Overall	221	108	48.87

The findings of the present study was supported by a recent research work of Islam *et al*. (2022), Howlader *et al*.(2017), reported younger are more infected than older ones; Nath *et al.* (2016) reported young (6 to 18 months) are more infected compared to adult animals. This might be due to adult being comparatively more resistant than the young to be infected with intestinal parasites. Sumbal Haleem *et al.* (2016) reported the prevalence of *F. gigantica* was 7.2% in adult cattle; 3.9% in young. This finding was contradicted by the statement of Sarder *et al.* (2006); Khandaker *et al.* (1993) who reported that the prevalence of *Fasciola gigantica* was highest in cattle of more than 36 months of age and lowest in the age of less than12 months. Karim *et al.* (2015) stated that bovine Fascioliasis was significantly ($p<0.01$) higher in old cattle (76.43%) compared to adult (68.69%) and young (48.62%). Bhutto *et al.* (2012) is also reported that the highest level of infections were found in older group i.e., above 6 years (62.62%) followed by in age groups of 4-6 years (57.28%), 2-4 years (42.56%) and up to 2 year (17.87%). The findings of the present study were varying from previous ones. In the present study, young (≥1-2 years) cattle was found more susceptible to clinical fascioliasis, it might be because calves and young cattle are frequently graze on the fields so they have much more exposure on circulating Cercariae and

Metacercariae . Farmers like to rear animals for fattening purposes and most of the cattle are considered for beef fattening between ≥1-2 years of age. Farmers used to bring their cattle into the hospital for treatment purposes at the very beginning of the fattening program. It is easier to transport younger animals than older ones. So, most of the young cattle were exposed to the veterinary hospital for treatment purposes. On the other hand this might be due to adult being comparatively more resistant than the young.

Prevalence of Fascioliasis on the basis of Sex

In the present study, the prevalence of Fascioliasis in females were higher (51.69%, 61/118) than in males (45.63%, 47/103) (Fig 4) the findings are similar to the findings of Islam *et al.* (2022); Howlader *et al.* (2017); Affroze S. *et al.* (2013**);** Karim *et al.* (2015); Nath *et al.* (2016). This findings is supported by the findings of Affroze S. *et al.* (2013**)**, who reported that female cattle (41.36%) are more susceptible than male (13.85%). Karim *et al.* (2015) reported that female cattle (70.3%) are more susceptible than male (55.23%). Nath *et al.* (2016) reported infestation of *fasciola sp* is more in female cattle (52.2%) than male (47.8%). Bhutto *et al.* (2012) reported incidence of Fascioliasis in females (45.08%) as much as double in comparison of males (20.89%). But Sumbal Haleem *et al.* (2016) disagree with the present findings who reported males (14%) are more susceptible than females (9.8%).

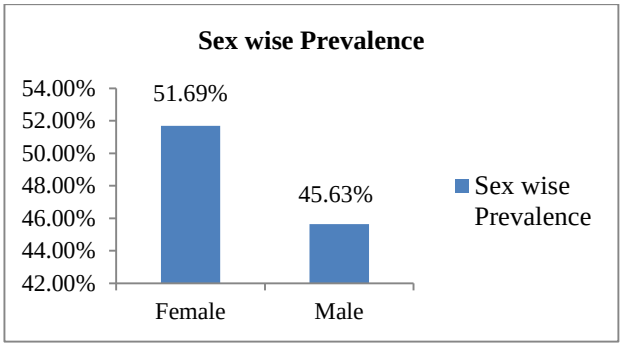

Figure 4: Sex wise prevalence of Bovine Fascioliasis

Female cattle were more susceptible to Fasciola infection than males. The exact cause of this is still beyond questionable, but females are physically and immunologically weaker than male cattle probably make them more prone to Fasciola infection, Molina *et al.* (2005) and Chowdhury *et al.* (1994). Variation in occurrence of such infections in male and female animals might be due to the variation in sample size (Bachal *et al.*, 2002).

Clinical Fascioliasis associated with breed

The prevalence of Fascioliasis between the local (Indigenous) and cross breeds were determined for this study (Fig. 5). The highest incidence was recorded in cross breed (54.4%, 68/125) followed by indigenous cattle (41.67%, 40/96). Cross breed cattle were highly susceptible than that of local cattle.

Present findings are strongly fitted with the previous study of Islam *et. al.* (2022), Khatun *et al.* (2015) and Hoque *et al.* (1998). Khatun *et al.* (2015) conducted a research in Chittagong district of Bangladesh and reported the occurrence of Fascioliasis is higher in cross breed (64.29%) cattle than local (35.71%). Howlader *et al.* (2017) reported Fascioliasis is higher in crossbreds

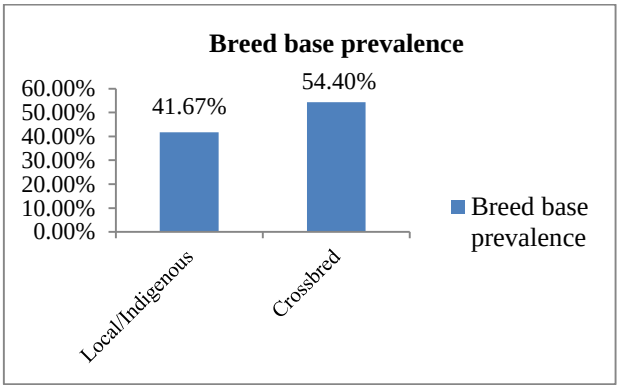

Figure 5: Breed wise prevalence of Bovine Fascioliasis

(60%) than local breds (42.68%) and Hoque *et al.* (1998) who reported that the mortality rate of cross breed calves is more than that of indigenous calves due to Fascioliasis. Most of the farmers of our country cannot fulfill the nutrient requirements of cross breed animals due to lower resistance capacity to Fascioliasis. Crossbreds are usually adapted in countries having relatively low temperature with minimal chances of parasitic exposure. The parasitic ecology and reproduction is closely related to an optimal environmental condition, which is not normally common in these countries. But, Bangladesh is a tropical country with a hot-humid environment which is favorable for parasite reproduction. For this reason, crossbred animals in Bangladesh become readily infected by parasites and different predisposing factors including managing of these animals in a parasitic load environment further worsen the condition.

Conclusion

Bovine Fascioliasis has serious economic impact on livestock production. The geo-climatic conditions together with water-logged and low lying areas in Kotalipara upazila are conducive to parasites in domestic ruminants. The hot and humid climates in fact make this country a paradise for parasites. Epidemiological investigation of Fascioliasis is considered as tools for controlling bovine parasitic infections. In Bangladesh, there is a lack of epidemiological record regarding Fascioliasis. Although, the present study results have some limitation because of low sample size, limited study areas and duration of the study may lead to improper diagnosis. Further epidemiological study is strongly recommended. Despite all constraints, the present study findings will help researchers for further epidemiological study of bovine Fascioliasis.

Acknowledgements

The author gratefully acknowledges Bangabandhu Academy for Poverty Alleviation and Rural Development (BAPARD), Ministry of LGRD and Co-operatives, Gopalganj, Bangladesh for funding the research work. The author also acknowledges the staff and colleagues who encourage and help to complete the research work.

Refferences

Abraham JT and Jude IB (2014) Fascioliasis in cattle and goat slaughtered at Calabar abattoirs. *Journal of Biology, Agriculture and Healthcare* **4:** 34-40.

Abunna F, Asfaw L, Megersa B and Regassa A (2010) Bovine fasciolosis: coprological, abattoir survey and its economic impact due to liver condemnation at Soddo municipal abattoir, Southern Ethiopia. *Tropical Animal Health and Production* **42:** 289-292.

Affroze S, Begum N, Islam MS, Rony SA, Islam MA and Mondal MMH (2013) Risk factors and gross pathology of bovine liver fluke infection at Netrokona district, Bangladesh. *Journal of Animal Science Advances* **3(2):** 83-90.

Alawa CBI, Adamu AM, Gefu JO, Ajanusi OJ, Abdu PA and Chiezey NP (2010) *In vivo* efficacy of *Vernonia amygdalina* (compositae) against natural helminth infection in Bunaji (*Bos indicus*) calves. *Pakistan Veterinary Journal* **30:** 215-218.

Alim MA, Islam MK, Karim MJ, Mondal MMH. (2004) Fasciolosis and biliary amphistomiasis in buffaloes in Bangladesh. *Bangladesh Vet J*. **38**: 1–9.

Amin MR & Samad MA (1988) Clinico-therapeutic studies on bovine fascioliasis. *Bangladesh Veterinarian* **5(1):** 20-22.

Bachal, B., Phullan, M.S., Rind, R., Soomro, A.H. (2002) Prevalence of Gastrointestinal Helminths in Buffalo Calves. Journal of Biological Sciences. **2(1):**43-45.

Banglapedia 2021. National Encyclopedia of Bangladesh. https://en.banglapedia.org/index.php/Agroecological_Zone.

Bhutto B, Arijo A, Phullon MS and Rind R (2012) Prevalence of fascioliais in buffaloes under different agroclimatic areas of Sindh province of Pakistan. *International Journal of Agriculture and Biology* **14(2)**: 241-245.

Boray J. C. (1982) Fascioliasis. In: Handbook Series in Zoonoses. Section C. Parasitic Zoonoses. Volume III (G.V Hillyer & CE Hopla edit), CRC Press, Boca Raton-Florida: 71-88,

Chakraborty P and Prodhan MAM (2015) Coprological prevalence of bovine fascioliasis, its epidemiology and economic significance in Chittagong district, Bangladesh. *Livestock Research for Rural Development* **27:**11-14.

Chowdhury SMZH, Mondal MMH, Islam FMS, Taimur MJFA, Biswas HR and Ershaduzzaman M (1994) Prevalence of fasciloiasis in cattle in Saver, Dhaka. Indian Veterinary *Journal* **71(2):** 121-123.

Fabiyi J. P., Adeleye G. A. (1982) Bovine fasciolosis on the job plateau, Nigeria with particular referent to economic importance. Bull Anim Health Prod Afr, **30(1):**41-43.

FAO: Rome, (1994) Diseases of domestic animals caused by liver flukes: epidemiology, diagnosis and control of Fasciola, paramphistome, Dicroceoelium, Eurytrema and schistosome infections of ruminants in developing countries.

Hammond J. A., Sewell M. M. H. (1974) The pathogenic effect experimental infection with Fasciola gigantica in cattle. Br Vet J, **130(5):**453-465,.

Hoque MM, Alam M and Rahman ML (1998) Helminth infection in cattle of Feni district of Bangladesh. *The Bangladesh Veterinarian* **9:** 105-106.

Hossain MM, Paul S, Rahman MM, Hossain FMA, Hossain MT, Islam MR (2011) Prevalence and economic significance of caprine fasciolosis at Sylhet district of Bangladesh. *Pakistan Veterinary Journal* **3:** 113–116.

Howlader BC, Rahman MM, Alam KJ, MOonmoon M and Howlader R (2017) Study on Prevalence Of Bovine Fascioliasis at Kotalipara Upzilla of Gopalganj District in Bangladesh. *International journal of innovative research* **2(1):**09-12

Islam M.R., Murshed H.M., Rahman M.M., Alim M.A., Hashem M.A., (2022) Prevalence of Bovine Fascioliasis at Kotalipara upazila of Gopalganj district of Bangladesh. International journal Agriculture and Biological Sciences, may- june 2022.

Karim MR, Mahmud MS and Giasuddin M (2015) Epidemiological study of bovine fasciolosis: prevalence and risk factor assessment at Shahjadpur upazila of Bangladesh. *Immunology and Infectious Diseases* **3(3)**: 25-29.

Khandaker MMU, Chanda PK and Rahman E (1993) Hepatic changes of cattle naturally infected with *Fasciola gigantica*. *Bangladesh Veterinary Journal* **3:** 33-44.

Khatun MS, Assaduzzaman M, Pallab MS, Chakraborty P (2015) Risk factors analysis of fascioliasis in two geo-climatic regions of Bangladesh. *International Journal of Scientific Research* **4(11):** 41-43.

Lazara R, Vazquez A, Domenech I and Robertson LJ (2010) Fascioliasis: can Cuba conquer this emerging parasitosis? *Trends in Parasitology* **26:** 26-34.

Legesse S, Tsegaye S, Lamesgen S, et al. (2017) Coprological Prevalence and Associated Risk Factors of Bovine Fasciolosis in and Around Zenzelma, Bahir Dar, Ethiopia. Eur Exp Biol **7:** 34.

Lessa CS, Scherer PO, Vasconcelos MC, Freire LS, Santos JAA and Freire NMS (2000) Registro de *Fasciola hepatica* equines (*Equus caballus*), caprinos (*Capra hicus*) ovinos (*Ovis aries*), no municipio de Itaguai, Rio de Janeiro, Brasil. *Revista Brasileira de Ciência Veterinaria* 7**:** 63-64.

Mahfooz A, Masood MZ, Yousaf A, Akhtar N and Zafar MA (2008) Prevalence and anthelmintic efficacy of Abamectin against gastrointestinal parasites in horses. *Pakistan Veterinary Journal* **28:** 76-78.

Mas, S. (2004). Human fascioliasis. In: World Health Organization (WHO*)*, Waterborne Zoonoses: Identification, Causes and Control, Publishing, London 22-305.

Molina EC, Gonzaga EA and Lumbao LA (2005) Prevalence of infection with *Fasciola gigantica* and its relationship to carcass and liver weights, and fluke and egg counts in slaughter cattle and buffaloes in Southern Mindanao, Philippines. *Tropical Animal Health and Production* **37(3)**: 215-221.

Nath TC, Islam KM, Ilyas N, Chowdury JK and Bhuiyan JU (2016) Assessment of the prevalence of gastrointestinal parasitic infections of cattle in

hilly areas of Bangladesh. *World Scientific News* **59**: 74-84.

Nooruddin M, Islam KS (1996) Distribution and body size of *Fasciola gigantica* in livers of Bengal goats in Bangladesh. *Small Ruminant Research* **19**: 189–191.

Rahman AR, Alim MA, Hossain MM, Yasin MG, Alam MZ, Hatta T, Anisuzzaman, Tsuji N, Mondal MMH (2019) Snail-borne trematodiasis in cattle in Barind tract of Bangladesh, an overlooked problem. *Jpn J Vet Parasitol* **18(2):** 53-64.

Rahman MH & Mondol MMH (1983) Helminth parasites of cattle (Bos indicus) in Bangladesh. *Indian Journal of Parasitology* **7(2):** 173-174.

Saleha AA (1991) Liver fluke disease (Fascioliasis): epidemiology, economic impact and public health significance. *Southeast Asian Journal of Tropical Medicine and Public Health* **91:** 361-364.

Sarder SA, Ehsan MA, Anower AKMM, Rahman MM and Islam MA (2006) Incidence of liver flukes and gastrointestinal parasites in cattle. *Bangladesh Journal of Veterinary Medicine* **4:** 39-42.

Siddiki AZ, Uddin MB, Hasan MB, Hossain MF, Rahman MM, Das BC, Sarker MS and Hossain MA (2010) Coproscopic and haematological approaches to determine the prevalence of helminthiasis and protozoan diseases of Red Chittagong Cattle (RCC) breed in Bangladesh. *Pakistan Veterinary Journal* **30(1):** 1-6.

Soulsby EJL (1982) Helminths, Arthropods and Protozoa of Domesticated Animals, 7th edition, The ELBS and Baillier Tindall, London, UK.

Spithill T.W., Smooker P.M., Copeman D.B. (1999) *Fasciola gigantica*: epidemiology, control, immunology and molecular biology. In: (Ed. J.P. Dalton) Fasciolosis, CAB International Publishing,Wallingford, 465–525.

Sumbal Haleem, Shadab, Faiza, Sadaf Niaz, Hameed Ur Rehman, ShazebSajad, Naveeda Akhtar Qureshi and Muhammad Kabir (2016) Prevalence of fascioliasis in cows and sheep in district Mardan (KPK), Pakistan. Journal of Entomology and Zoology Studies **4(3):** 330-334.

Tembely S, Coulibaly E, Dembele K, Kayentao O & Kouyate P (1995) Intermediate host populations and seasonal transmission of *Fasciola gigantica* to calves in central Mali, with observations on nematode populations. *Preventive Veterinary Medicine* **22 (1-2):**127-136.

Torgerson P., Claxton J. (1999) Epidemiology and control. In: (Ed. J.P. Dalton) Fasciolosis, CAB International Publishing, Wallingford, 113–149.

Troncy PM (1989) Helminthes of livestock and poultry in Tropical Africa. In: Fischer. Manual of Tropical Veterinary Parasitology. pp. 63-73CAB international, UK .

Yadav SK, Ahaduzzaman M, Sarker S, Sayeed MA, Hoque MA (2015) Epidemiological survey of fascioliasis in cattle, buffalo and goat in Mahottari and Dhanusha, Nepal. *Journal of Advance Parasitology* **2(3)**: 51-56.

Yasin MG, Alim MA, Anisuzzaman, Ahasan SA, Munsi MN, Chowdhury EH, Hatta T, Tsuji N, Mondal MMH. (2018) Trematode infections in farm animals and their vector snails in Saint Martin's Island, the southeastern offshore area of Bangladesh in the Bay of Bengal. *J Vet Med Sci* **80:** 684-688.