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PATHOLOGICAL INVESTIGATION OF LIVER FLUKE INFECTION OF SLAUGHTERED BLACK BENGAL GOAT IN A SELECTED AREA OF BANGLADESH

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ABSTRACT

This study was conducted in Sylhet district of Bangladesh to investigate the pathological effect of liver fluke in Black Bengal goats of different age groups, sex and in seasons. In this study, livers of male and female goats were collected randomly from slaughter house during a period of 1 (one) year (November, 2007 to October, 2008). A total of 325 Black Bengal goat livers were examined, of which 70 livers were found infected with *Fasciola gigantica.* The common histopathological changes found in this study were the migratory tract with lymphocytic infiltration, atrophy, necrosis and fatty changes in the liver. The study revealed that age of the animal has significant effect on Fascioliasis in goats. Significantly ($P<0.01$) highest infection rate was found in 2-2.5 years old animals (50%). The sex of the animal was also found as important determinants for Fascioliasis. In this study out of 219 male goat livers 30 (13.70%) were infected with Fasciola. On the other hand, out of 106 female goat livers, 40 (37.73%) were found positive with Fascioliasis. The data of origin of animals also collected which was not statistically significant.

Keywords: Pathology, liver fluke, Black Bengal Goat

INTRODUCTION

Parasitism is one of the main causes limiting livestock productions in most of the tropical and sub-tropical countries of the world. In Bangladesh, parasitism has been considered as one of the major constraints of livestock production (Jabbar & Hag, 1983). The incidence of parasitic diseases in the domestic ruminants of Bangladesh is also high and as a result hardly any livestock industry could develop here. There are about 38.1 million small ruminants (goat and sheep) in Bangladesh (FAO, 2005) which plays an important role in the rural economy and earn substantial amount of foreign currency by exporting skins and other by-products (Kamaruddin, 2003). Besides a large number of helminth parasites these are constantly deteriorating the health and productivity of the ruminants, *Fasciola gigantica* is by far the pre-dominant species of outstanding importance. The pathogenic effect of this parasite is extended over a large number of domestic ruminants; cattle, sheep, goats and buffaloes are mostly affected and drain a substantial economic loss to the country annually. Infection with *Fasciola gigantica* is regarded as one of the most common single helminth infection of ruminants in Asia and Africa (Hammond & Sewell 1990). This disease causes enormous economic losses all over the world and these losses are due to reduction in milk and meat production, condemnation of liver, loss of draught power, reproductive failure and mortality (Diaw *et al*., 1998). Recently, worldwide losses in animal productivity due to Fascioliasis were conservatively estimated at over US $ 3.2 billion per annum. In addition, Fascioliasis is now recognized as an emerging human disease. The World Health Organization (WHO, 2006) has estimated that 2.4 million people are infected with *Fasciola hepatica* and a further 180 million are at risk of infection. The overall prevalence of *Fasciola gigantica* in goats with gross and histopathological changes in the liver and also its relationship with age, sex and seasons has been described in this paper. So, for controlling the disease in this area, appropriate preventive control strategies have to be designed to reduce the impact of the disease on goat production in Bangladesh.

MATERIALS AND METHODS

The study was carried out in the Laboratory under the Department of Pathology & Parasitology, Sylhet Agricultural University (SAU) and Chittagong Veterinary and Animal Sciences University (CVASU) from November 2007 to October 2008. Data were collected from 86 butchers in Sylhet metropolitan area. After collection of the liver samples of goats, they were examined in the Laboratory. In this study, livers of both sexes

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of Black Bengal goat of different age groups slaughtered at different slaughterhouses under Sylhet City Corporation were collected randomly. The goats were purchased by the butchers from different areas of Sylhet division where they were reared under the rural husbandry practices. The age of animals was determined by dentition. A total 325 livers were collected and examined in the laboratory for confirmation of Fascioliasis. At first the liver was examined for gross lesions of liver fluke infection following the procedure of Ross (1965) and those showing evidence of the infection were marked.

Examination of liver, gall bladder and collection of parasites

In the laboratory the livers and gall bladders were subjected to thorough investigation for the collection of parasites as well as for pathological studies. The gross pathological changes were recorded carefully. The bile ducts were opened first for chronic Fascioliasis. For generalized liver fluke infection (Fascioliasis) incision was given in different parts of the liver to examine the presence of fluke in the parenchyma. The liver was cut into slices of 4-5 mm. thickness using a sharp knife and pressed to squeeze out flukes from its tissue and smaller bile ducts. Normal saline were used for quick removal of flukes from the liver tissue.

Histopathology

The histopathology was carried out in the pathology laboratory of Chittagong Veterinary and Animal Sciences University (CVASU). The fixed liver tissue of animals having *Fasciola gigantica* infection was processed, sectioned and stained according to the method of Arora and Iyer (1973) for histopathological studies. Pieces of diseased liver tissue about one cubic cm. in size were fixed in 10 percent buggered neutral formalin. The well fixed tissues were transferred to running water and after proper washing they were dehydrated through a series of ascending grades of alcohol, cleared in two changes of chloroform and finally, embedded in hard paraffin (58^0c). Sections were cut at 5 to 6 microns by using a rotary microtome. All the sections were stained routinely with Harris's Haematoxilin and Eosin for detailed histopathological examinations.

Statistical Methods

Variations in the prevalence of Fascioliasis among the male and female Black Bengal goats, the different age groups, seasonal incidence and immature and mature fluke prevalence were analyzed by logistic regression using statistical software STATA (Version 8.0) and Microsoft Excel 2007. Categorizes were as per season, sex and age. Values of $p<0.05$ were considered as significant at 95% confidence interval. The relationship of different variables with the infection was observed by this regression analysis.

RESULTS AND DISCUSSION

In this study, a total of 325 livers from Black Bengal goats were examined of which 70 (21.54%) were found to be affected with Fascioliasis. The infection rate was higher in older animal than young (Table 1) which is in agreement with the result of other workers (Chowdhury *et al*., 1994; Tasawar *et al*., 2007). Similarly, Keyyu *et al*. (2005) reported that the high infection rates in older animals associated with age and consequently longer exposure time. Females were more affected than males (Table 1). This finding is conformity with other workers (Chowdhury *et al*., 1994; Maqbool *et al*., 2000). Female goats were found to be more infected and were probably due to the fact that the female goats in this country are slaughtered at older age. Goats were more infected in rainy than in summer and winter seasons (Table 1). This observation appeared in agreement with the earlier reports (Selim *et al*. 1997 & Maqbool *et al*., 2000).

Table 1. Infection rate of Fascioliasis in all categorical variables in Black Bengal goats

Variable	No. of livers examined	Positive cases (percentage %)
Age		
Up to 1 year	34	01 (2.94)
1- 1.5 years	87	15 (17.24)
1.5- 2 years	170	39 (22.94)
2- 2.5 years	28	14 (50.00)
2.5 -3 years	06	01 (16.67)
Sex		
Male	219	30 (13.70)
Female	106	40 (37.73)
Season		
Rainy	113	29 (25.66)
Summer	106	20 (18.87)
Winter	106	21 (19.81)

Pathological investigation of liver fluke

Clinical examination of the *Fasciola gigantica* infected goats showed pale visible mucous membrane to a large extent as where a very few infected goats suffer from 'bottle jaw' syndrome. *Fasciola gigantica* causes extensive hemorrhage in liver parenchyma in acute Fascioliasis and ingestion of blood by adult flukes leading to pale mucous membrane. On the other hand, 'bottle jaw' syndrome may occur occasionally when massive Fasciola infection causes sufficient liver destruction leading to cessation of protein synthesis.

The gross pathological changes of the liver in chronic Fascioliasis characterized by increase in the size of the organ due to inflammatory changes in the parenchyma and fibrosis of the bile ducts containing adult flukes. In acute form, the livers were slightly swollen or enlarged with rounded edges and the color became paler than normal with numerous small and large hemorrhagic patches scattered over the parietal surface of the left, right and caudate lobe (Fig. 1) and (Fig. 2).

This research work was carried out to determine the pathological investigation of Fascioliasis from slaughtered Black Bengal goats of different age groups, sex and in seasons. A total of 325 livers from slaughtered goats was examined of which 70 (21.54%) were found to contain immature and mature Fasciola. So, the overall prevalence of Fascioliasis was 21.54%. Alternatively, Islam & Taimur (2008) and Selim *et al.* (1997) reported a relatively lower prevalence rate of *Fasciola gigantica* in goat which was 14.28% and 8.70% respectively. The heavy rainfall in the region might be one of the causes of higher prevalence of the disease in this study.

Like Roberts (1968), Acosta-Fereira *et al* (1980), Ross *et al.* (1967), Dow *et al.* (1967) and Sengupta and Iyer (1968), both acute and chronic forms of fascioliasis have been detected in the present study. The gross pathological changes in acute fascioliasis described by these authors may be summarized as light hemorrhagic spots or elongated tracks occurring on the surfaces of the liver.

The histopathological examination also revealed the presence of numerous eosinophils admixed with few lymphocytes and accompanied by hemorrhage and edema in acute Fascioliasis. This study partially correlated the findings of Dow *et al.* (1967) who recorded the changes of liver in experimentally produced Fascioliasis in calves. However, the occurrence of thrombi in the branches of portal and hepatic veins as observed by this author were not seen in this study. On the other hand, the migrating flukes produced little reaction in the host tissue and in the later stages they became surrounded by macrophages, eosinophils and granular tissue. Early of the flukes into the bile ducts resulted in proliferation of the epithelium producing a granular mucosa which was found in the present study. Ross *et al.* (1967) described similar pathological changes in acute fascioliasis in calves and pig livers, respectively. According to Ross (1966) acute pathological lesions could only be produced by developing flukes prior to their entry to the bile ducts.

The histopathological changes in chronic Fascioliasis were characterized by infiltration of fibroblasts admixed with lymphocytes and few mononuclear cells in the area previously migrated by young flukes. Similar statement was made by Dow *et al.* (1967) and Smith *at al.* (1972). Huge proliferations of fibrous connective tissue associated with infiltration of lymphocytes and plasma cells in the portal area were commonly seen. Liver section showed atrophy, necrosis and fatty changes due to chronic Fascioliasis in goat (Fig: 3&4). Formation of blebs at the free margin of the epithelial cells undergoing hyperplasia was a common picture. Most advanced stages hyperplasia led to the formation of gland-like structures. The mucosa was often infiltrated with plasma cells and few eosinophils. Formation of new bile ducts and deposition of bile pigment in the tissue space were seen (Fig: 6). Thickening of the bile ducts and fibrosis in a portal area due to chronic Fascioliasis also found (Fig: 5). Migratory tract with lymphocytic infiltration was more common case (Fig: 8). Sections of immature flukes surrounded by clear spaces were found in the dilated and thickened bile ducts. (Fig: 7). The adult *Fasciola gigantica* was noticed in cross section in the lumen of the thickened bile ducts (Fig: 9).These findings substantiated the observations of Acosta-Fereira *et al*.(1980), Ross (1966), Ross *et al.* (1967), Dow *et al*. (1967), Sengupta and Iyer 1968, Uzoukwn and Ikeme1978, Smith *et al*. (1972). They added that the cytoplasmic blebs at the free margin of the epithelial lining cells were the first indication of intense hyperplasia. In this investigation, no brilliant cell was seen in the areas of adenomatous proliferation of the biliary epithelium in the goat liver as described by Shirai *et al.* (1976) in cattle liver. No calcification in the wall of the bile ducts in chronic Fascioliasis in goat could be seen in this study. Similarly, according to Simesen (1968) and Pullan *et al.* (1970), the bile ducts of the liver in sheep never calcified, contrary to findings in cattle Ross, 1966 and Dow *et al*. (1967). Ross *et al.* (1967) reported that there was no calcification in the pig liver in chronic Fascioliasis. The difference in calcification might be due to species variation.

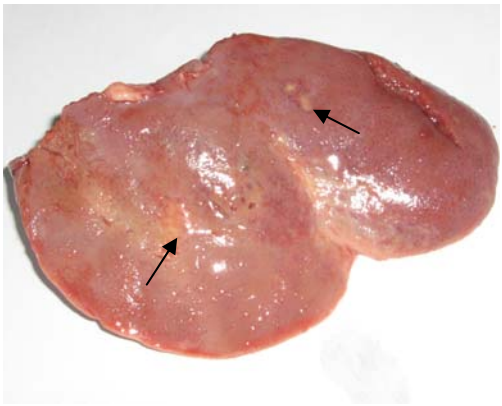


Fig. 1. Acute form of Fascioliasis in left and right lobe of liver of Black Bengal goat

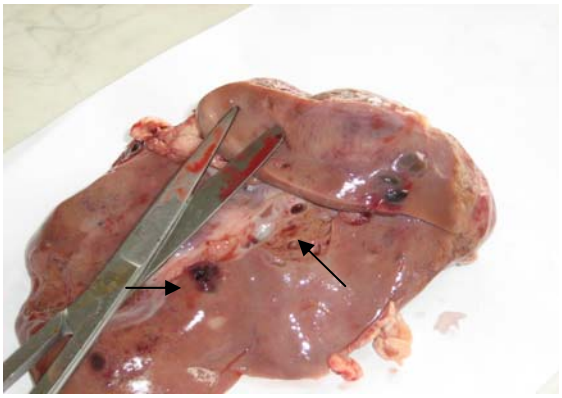
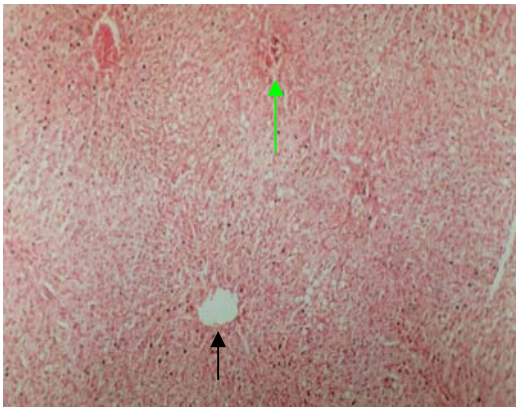
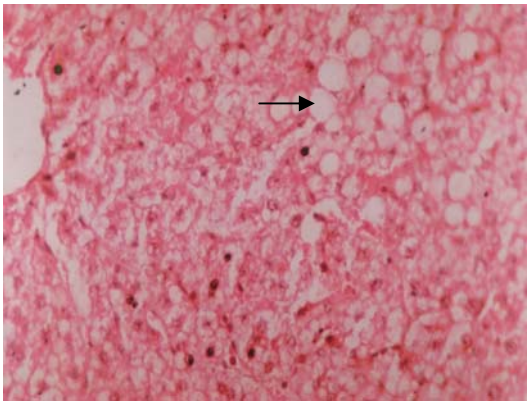


Fig. 2. The bile ducts were greatly dilated in Fasciola infected goat liver



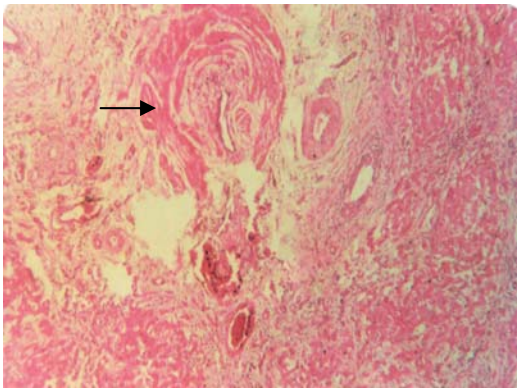
→Atrophy → Necrosis →Fatty changes

Fig. 3. Liver section showing atrophy, necrosis and fatty changes due to chronic Fascioliasis in goat (H & Ex10)



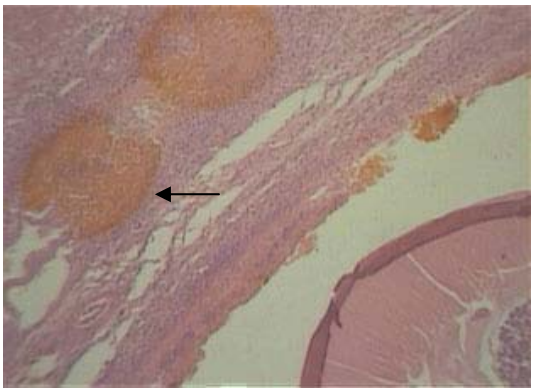
→ Fatty changes

Fig. 4. Higher magnification of Fig 3 (H & E x 40)



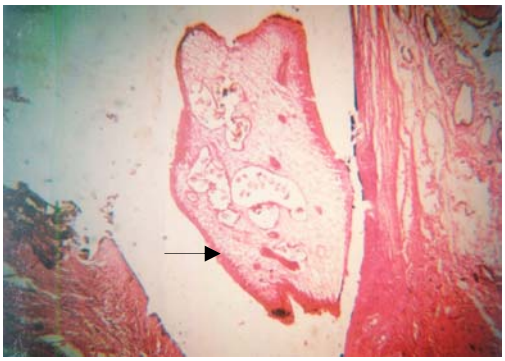
→ Fibrosis

Fig. 5. Thickened bile duct and fibrosis of chronic Fascioliasis (H & E x 10)



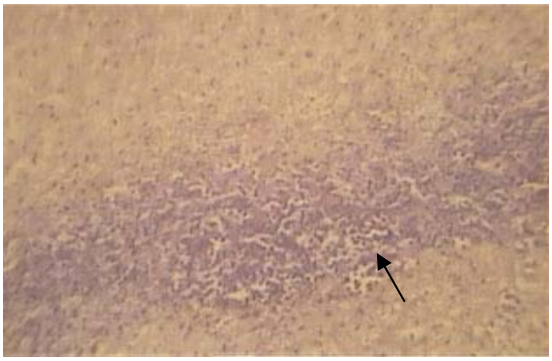
→ Bile pigment

Fig. 6. Deposition of bile pigment of a goat liver (H & E x 40)



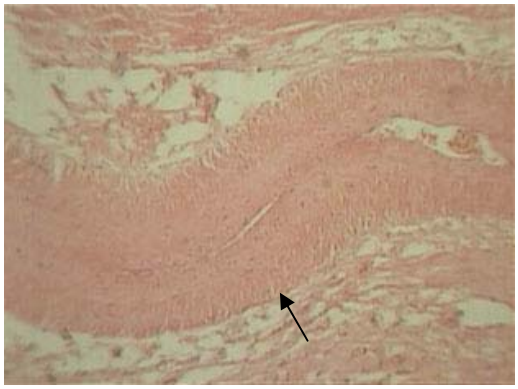
→Fasciolla cross section

Fig. 7. Cross section of a Fasciola of a goat liver (H & E x 40)



→Migratory tract with lymphocytic infiltration

Fig. 8. Migratory tract with lymphocytic infiltration of goat liver



→ Immature fluke

Fig. 9. Immature fluke in dilated and thickened bile duct (H & E x 40)

CONCLUSION

The climatic condition of Bangladesh is favorable to the ecological conditions suitable for parasites of which helminthes parasites are predominant. Various liver diseases affect the structural and functional integrity of the organ and render it partly or wholly unfit for human consumption causing considerable losses. Diseases of the liver of goats and the loss from the condemnation of liver in Bangladesh have been studied. This loss can be minimized by identification of the diseases and undertaking preventive and therapeutic measures. In the present study, 325 livers were examined of which 70 (21.54%) were found to be affected with liver fluke (*Fasciola gigantica*). Of these 70 Fasciola affected livers, 40 (57.14%) belonged to female and 30 (42.86%) to male goats. Gross and histopathological changes of each of the recorded disease conditions are described and discussed. The common histopathological changes were migratory tract with lymphocytic infiltration. After review of the results obtained from this investigation the following conclusions may be drawn:

1. Livers of Black Bengal goats are mostly affected with parasitic disease like Fascioliasis.
2. Fascioliasis (*Fasciola gigantica*) is greatly responsible for hepatic damage and demands immediate attention for taking control and eradication measures.
3. Livers of female goats were found to be more prone to diseases than those of male goats.
4. Probably Fascioliasis (*Fasciola gigantica*) is the major cause of reduction of meat production of Black Bengal goats.
5. The prevalence of Fascioliasis (*Fasciola gigantica*) is higher in older animals.
6. The results of this study do not represent the total goat population in Sylhet region. So, further study could be undertaken on the basis of geographical location.

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