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Epidemiological investigation of amphistomiasis in ruminants in Bangladesh

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Abstract

Epidemiological investigation on amphistomiasis through examination of viscera and faeces of 267 cattle, 120 goats, 67 sheep and 36 buffaloes in some parts of flood plains, hilly and coastal areas of Bangladesh during July, 1998 to June, 2001 revealed all types of animals infected with at least three or more species of amphistomes in all seasons of the year. The amphistome species were *Gastrothylax crumenifer, Paramphistomum cervi, Cotylophoron cotylophorum, Gigantocotyle explanatum and Homalogaster ploniae.* Simultaneous examination of 10,404 freshwater snails revealed 9 species of which at least five species namely *Indoplanorbis exustus, Lymnaea* spp. *Thiara tubrculata, Bithynia tentaculata and Gyraulus convexiusculus* were detected as the possible intermediate host of amphistome flukes. The vector snails were prevalent round the year in almost all areas of the country except the extreme sea shores. There was a significant ($p<0.05$) variation in the distribution of the vector snails, *Lymnaea* spp, *Indoplanorbis exustus* and *Gyraulus convexiusculus* in the different seasons of the year. The *G. explanatum* mostly in the buffaloes and some cattle while *H. ploniae.*occurred in the caecum of some cattle and sheep only. The proportion of immature, young and adult amphistomes in different species of animals varied considerably, more adult amphistomes were recorded in cattle and buffaloes than in sheep and goats. The population density of amphistome was also high in cattle and buffaloes than in sheep and goats, lowest numbers of 50 in a goat and highest numbers of 7,538 in a cow. The burden of mature worms was more in aged animals (>4 years) than in young (<2 years).

Keywords: Amphistomiasis, Ruminants, Epidemiology, Bangladesh

Introduction

Amphistomiasis is a snail borne trematode parasitic disease of ruminants caused by several species of the paramphistomes/amphistomes (Digenia: Paramphistomatidae). The disease is widely distributed in most tropical and subtropical countries of the world (Soulsby, 1982). However, the magnitude of the disease vary with the geographical variation because of the availability of suitable intermediate host snails and climatic factors (Bray, 1985). In Bangladesh, about 60%-90% ruminants are known to be infected with amphistomes, especially with adults (Islam *et. al.* 1992). Generally it is believed that the adult amphistomes are fairly harmless or nonpathogenic (Soulsby, 1982) to ruminants.. The colossal effect of immature amphistomes in the intestines of young ruminants is well known (Sukhapesna, 1992; Pande and Misra, 1980; Hossain and Baki, 1987). Many field veterinarians in Bangladesh are now in the opinion that the pathogenic effects of adult amphistomes are much more than is believed. But very little is known about the epidemiology of this disease in Bangladesh. Therefore, this study was undertaken to investigate the epidemiology of amphistomiasis in ruminants with a view to know the actual status of the adult amphistomiasis in ruminants in Bangladesh.

Materials and methods

Visceral organs and faeces of 267 cattle, 120 goats, 67 sheep and 36 buffaloes were examined from flood plains of Mymensingh and Dhaka, hilly areas of Mymensingh, Chittagong and Chittagong Hill Tracts and coastal regions of Feni of Bangladesh for amphistome flukes. The samples were brought to the laboratory and processed by following the method of Soulsby (1982). As far as possible the identification of the parasites were made by following the description of Varma (1957). A total of 10,404 freshwater snails of different species from different permanent and temporary water bodies in the areas mentioned above were collected and identified as per the descriptions of Brown (1980). The characteristics of the snail habitats including the presence or absence of aquatic vegetations, depth and pH of water were recorded. Some representative samples of the snails were also examined in the laboratory for the presence of amphistome cerecariae following the procedure of Malek and Cheng (1974). The cercariae releasing snails were placed in the aquarium containing the aquatic vegetation to study the time and site of attachment and encystment behabiour of the cercariae. The meteorological data were collected from the respective areas and correlated with the disease. The various factors governing the epidemiology of amphistomiasis in ruminants were also taken into account as per Armour (1980).

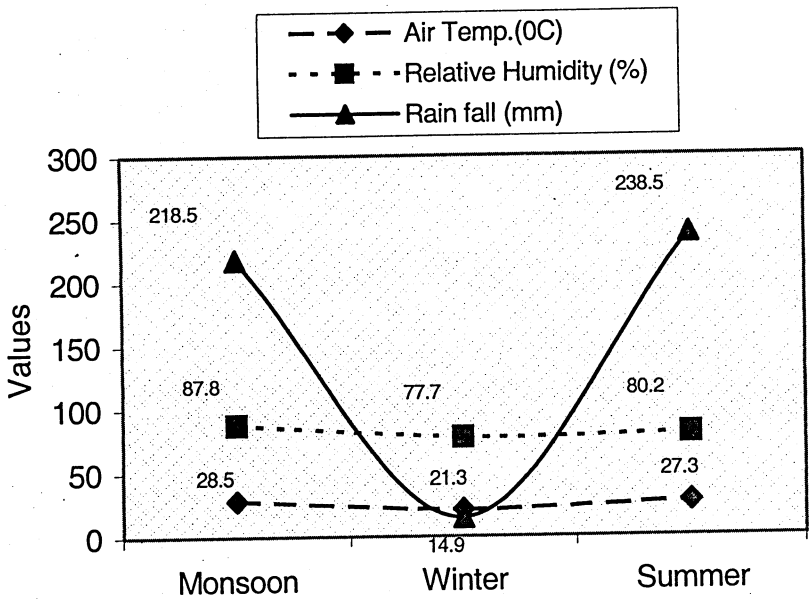

Fig. 1 The average meteorological data in three different seasons in Bangladesh.

Statistical analysis

Data were subjected to ANOVA, followed by simple "t" test to evaluate the significant difference among the observed values for each variable (Steel and Torrie, 1960).

Results and Discussion

Status of the diseases in cattle, sheep, goats and buffaloes

This investigation revealed 100% infections by amphistome flukes in all species of animals examined from flood plains, hills and coastal areas of the country (Table -1). Most of the animals harboured at least 3 or more species of amphistome flukes of all stages of development (immature, young and adult). The species of amphistomes were, *Gatrothylax crumenifer, Paramphistomum cervi, Cotylophoron cotylophorum, Gigantocotyle explanatum and Homalogaster paloniae.* Except for *Gygantocotyle explanatum* and *Homalogaster paloniae*, adults and young of all species were found to concentrate in the walls of the rumen and reticulum, and the immature mostly in the duodenum and some in the abomasum. *Gygantocotyle explanatum* invaded the bile ducts of buffaloes and some cattle, while *Homalogaster paloniae* invaded the caecum of cattle and sheep. The parasitic load varied from animal species to species or even within the same species of animals. The worm load was more in cattle and buffaloes than in sheep and goats which ranged from 174 to 7538 in cattle, 250 to 3725 in buffaloes, 175 to 650 in sheep and 50 to 450 in goat. The ratio of mature, young and immature amphistomes in cattle and buffaloes was 5.7 : 2.75 : 1, in sheep, 2.22 : 1.55 : 1 and in goats 1.66:133:1. Of the animal species examined cattle and buffaloes seem to be the most appropriate host of amphistomes, because of maintaining a higher burden of mature worms throughout the year than sheep and goats. The reasons of being cattle and buffaloes more infected than sheep and goats are not clear. However, the experimental evidence of the work of Horak (1967) from South Africa suggests cattle as the most suitable hosts for *Paramphistomum microbothrium.* Because the percentage of metacercariae intake was more consistent, migration to the rumen more rapid, worms larger, pre-patent period shorter, egg production maintained at a higher level and adult worms lived longer in cattle than either in goats and sheep. Horak (1967) also concluded that if cattle are not the normal hosts at least they are better adapted hosts than either of the other domestic animals (sheep and goats). A high burden of adult worms were counted in aged animals (>4 years) than in young (<2 years) which indicated that the older animals were the main source of pasture contamination by shedding large numbers of amphistome eggs. This allowed the non-infected young animals to get infected with the amphistomes at the time of unguarded grazing in the wetland containing metacercaria. Apparently the amphistomes burden was also high in malnourished animals than the well-nourished animals kept in stall fed condition. This was evident by the fact that the worm burden was high in the animals that were slaughtered at different markets round the year than those were slaughtered during the Eid-ul-Azha festival at the Bangladesh Agricultural University campus. The bulls and male castrated goats that were sacrificed during the Eid were healthy and robust because of good feeding and management, while most of the animals slaughtered at the abattoirs were emaciated. In an earlier report about 60% to 90% slaughtered animals were found infected with amphistomes (Islam *et al.*, 1992) but without mentioning worm load in the infected animals. Estimation of the load of amphistomes in a particular animal or animal species determines the nature and magnitude of the disease or disease syndrome caused by the amphistomes. In this context Whitten (1955) has pointed out that under pasture condition in Newzeland immature amphistome burden of approximately 2,000 worms caused the death of a two toothed ewe. However, in the present investigation although amphistome burden in many cases exceeded 2,000 but the animals were thriving well until slaughtered. This is indicative to chronic infections in most of the cases. It is possible that due to repeated exposure of the animals to amphistomes from the contaminated pastures the animals developed some degree of immunity.

Amphitomiasis was prevalent round the year with number of mature and young worms during March to October, and immature during November to February mostly. The amphistomes cercariae develops in the snail intermediate hosts by 4 weeks at 20-26^{0}C environmental temperature (Urquhart *et al*, 1996). In the monsoon (July to October) the snails are dispersed into the previously dry areas by flooding during the heavy rains. The amphistome eggs deposited in these areas by the infected grazing animals hatch and infect snails. The subsequent release of cercariae from the snails often coincides with receding water levels and the grazing animals are easily infected. In the winter (November to February) most of the water lodged areas dries out when naturally the animals and snails are concentrated in the small water bodies which expose the animals to contract the infection. The pre-patent period of amphistomes varies from 7-10 weeks depending upon the parasites and host involved (Urquhart *et al*, 1996). So, the metacercariae ingested at the end of the monsoon and in the early winter develops to mature amphistomes in winter and summer respectively. The metacercariae remain viable for infection for about 3 months on the herbage (Soulsby, 1982). Moreover, The snails that aestivated in the dry season become reactivated on the return of first rain in the summer and contribute to infection to the ruminants in the summer. There is no evidence of auto expulsion of amphistomes from the host body once the animals are infected. So the parasites remain in the host for a longer period of time and all these make a year round prevalence of amphistomiasis in the ruminants.

Table 1. Prevalence (%) of amphistomes in different topographic zones in Bangladesh

Animal species	Flood plains	Hilly areas	Coastal belts
Cattle (n==267)	100 (140)	100 (85)	100 (42)
Buffalo (n=36)	100 (27)	100 (03)	100 (06)
Goat (n=120)	100 (78)	100 (30)	100 (12)
Sheep (n=67)	100 (04)	100 (05)	100 (58)

Figures in the parentheses indicate number of animals examined.

Table 2. Seasonal occurrence of different snails in Bangladesh. (Three years average data)

Snail Species	Monsoon (Jul-Oct)	Winter (Nov-Feb)	Summer (Mar-Jun)
***Lymnaea* spp.** (n=2862)	746	943	1173*
***Indoplanorbis* sp.** (n=3310)	1291*	831	1188
Vivipra sp. (n=1487)	944	251	292
***Gyarulus* sp.** (n=660)	231	139	290*
Brotia sp. (71)	41	30	Nil
Ampularia (*Pila*) sp. (n=95)	79	Nil	16
***Bithynia* (*Bulimus*) sp.** (n=1,591)	853	413	325
***Thiara* (*Melanoides*) sp.** (n=328)	125	160	43
Total (n=10,404).	4310	2767	3327

Bold face indicates the vectors of amphistomes in the present investigation.

*Indicates the significant ($p<0.05$) difference among the observed values in the same row.

Vector snails and their habitats

Since amphistomiasis is a fresh water snail transmitted disease of livestock (Soulsby,1982), attempts were made to incriminate the possible vector snails from flood plains, hilly and coastal regions of the country. This revealed as many as nine species of snails. Of them, at least, five species have been found involved in the transmission of amphistome flukes in the country. The species of the snails and their seasonal abundance are shown in Table-2. Except for *Lymnaea* spp. all the snails that harboured amphistome cercariae were found to occur in all areas of investigation of the country. All permanent and temporary water bodies were suitable for snails breeding except extreme sea shore. Amphistome cerecariae were much more abundant in the snails during September to November than other months of the year. Snail densities in different water bodies were also dependant on changing of seasons, high during April to June and September to November. Heavy down pouring and flooding were detrimental to snails and the development of amphistome in them as well. Moderately clear water of 3 to 5 inches depth with disperse to dense vegetation was ideal for he vector snails of amphistomes. On the contrary, flowing water of rivers and clear pond water devoid of vegetation were unsuitable for the vector snails. The pH of the water of all snails breeding areas was almost neutral to slightly alkaline. Encystment behaviour study of the amphistome cerecariae showed that the attachment of the cercariae on to the aquatic vegetation occurred within 24 hours to 72 hours of release from the vector snails. The attachment site of the cercariae for encystment to become metacercariae on the herbage was just at the water level, which further migrated towards upper part of the vegetation at about 4-7 inches above water level. This was just reverse to *Fasciola* cercariae which encysted below water level and hardly migrated upwardly. Most of the snail species got concentrated during dry seasons in the water bodies with abundance of aquatic vegetation. Therefore, succulent vegetation in the ditches, canals, foot prints of animals and man especially during the drier months of the year in the low lying area was the main source of amphistome infection for animals. This observation is in conformity with the study of Mattison *et al* (1995) in India.

It can be concluded that amphistomiasis, whether due to immature or adult amphistomes, is a problem of cattle, sheep, goats and buffaloes in all seasons of the year in almost all topographic areas of Bangladesh beacuse of the abundance of fresh water vector snails. However, special care must be taken to allow livestock in wet pasture during September to November, since a high numbers of cercariae are released in this period from the intermediate host snails and contaminate aquatic herbage easily.

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