A Cross Sectional Study on the Prevalence and Possible Risk Factors of Bovine Schistosomiasis in and Around Bahir Dar Town, Northwest Ethiopia

Samuel Abie, Sefinew Alemu, Samuel Derso, Yitayew Demessie and Dagmawi Yibarek

Faculty of Veterinary Medicine, University of Gondar, Gondar, Ethiopia, P.O. Box 196

Abstract: A cross sectional study was conducted from October, 2014 to April 2015 in and around Bahir Dar town, North-western Ethiopia in order to estimate the prevalence and possible risk factors of bovine Schistosomiasis. Simple random sampling was used to select the study animals and coprological examination using sedimentation technique for the recovery of Schistosoma eggs from freshly collected faecal samples. Out of 354 faecal samples examined 93(26.3%) were found positive for bovine Schistosomiasis. The prevalence of bovine Schistosomiasis was higher in local breed cattle (27.5%) than cross breed cattle (21.8%). Similarly, the prevalence of the disease in male and female cattle was 24.4 and 27.8%, respectively. However, there was no statistically significant difference (p>0.05) between the two breeds and sexes. The prevalence of the disease was highest in cattle of Sebatamite (37.3%) followed by Kebele nine (28.0%) and the lowest prevalence was observed in cattle of Zenzelima (13.6%). There was statistically significant difference observed among the three studied sites (p<0.05). Cattle having less than 2 years, 2-5 years and greater than 5 years old had (17.1%), (28.7%) and (26.1%) disease prevalence, respectively without having any significant statistical difference (p>0.05). The highest prevalence of Schistosoma infection was observed in poor body conditioned animals (36.8%) followed by medium body conditioned animals (19.7%). Whereas, the lowest prevalence of the disease was observed in good body conditioned animals (10.6%). There was also statistically significant difference among different body conditioned animals (p<0.05). The prevalence of the disease was highest in extensively managed animals (30.5%) in relative to semi intensive (16.7%) and intensive management system (10.0%). And also there was statistically significant difference among the three management systems (p<0.05). Therefore, this study indicated that bovine Schistosomiasis is becoming one of the major cattle health problems in and around Bahir Dar. Accordingly, farmers should be advised and educated regarding to the reduction of the disease and its intermediate host and also strategic use of deworming and treatment should be practiced.

Key words: Bahir Dar • Bovine • Coprology • Prevalence • Schistosomiasis • Sedimentation

INTRODUCTION

Schistosomiasis or Bilharziasis is a disease caused by trematodes of the genus Schistosoma with different species. The taxonomic classification of the organism is presented as kingdom Animalia, Phylum Platyhelminthes, class Trematoda, sub class digenea, Family Schistosomatidae, Genus Schistosoma and species Schistosoma bovis, Schistosoma leiperi, Schistosoma mattheei, Schistosoma mansoni, Schistosoma hematobium, Schistosoma nasalis, Schistosoma japonicum, Schistosoma spindale, Schistosoma indicum and Schistosoma Interkalatum [1].

Schistosomes are dioecious (separate sex) trematodes or flukes with flat bodies [2], which live in the vascular systems (mesenteric vein, portal vein), bladder and typically in other organs of their definitive hosts [3]. The term Schistosoma means split body and refers to the fact that the males have a ventral groove called gynaecophoric canal where, the adult female is permanently lying.

Schistosomiasis is common in many tropical and sub tropical areas as well as in Africa, Asia and India. Schistosoma bovis Schistosoma mattheei, Schistosoma Interkalatum, Schistosoma spindale, S.nasalis and Schistosoma indicum have significant veterinary importance in livestock production in Africa, Asia and
The distribution of Schistosoma infection varies from place to place. *Schistosoma bovis* is the commonest species in Africa and Mediterranean region [5] whereas; *Schistosoma spindale*, *Schistosoma indicum* and *Schistosoma nasalis* have been reported in Asia as the major cause of Schistosomiasis [4].

Some geographical areas like, small streams, ponds, swampy areas around rivers and lakes (in Ethiopia, Lake Tana, Ziway, Abay River) and in irrigation sites can act as source of infection for Schistosomiasis. However, the distribution of the disease has been primarily determined by the distribution of snail intermediate host, particularly *Bulinus* and *Physopsis* species which are important for bovine Schistosomiasis [3].

Ethiopia is highly endemic for Schistosomiasis, since temperature in Ethiopia appears to be the major factor that affects the distribution of Schistosoma species [6]. Schistosomiasis is a chronic debilitating infection that affects both animals and humans by its different species. It is one of the major concerns of animals in the world [2, 7] and the disease has Public health importance [8]. It can cause high economic losses by resulting mortality, low fertility, retarded growth, poor productivity, low milk yield and increased susceptibility to other disease in livestock [9].

In Ethiopia, various epidemiological studies were conducted on bovine Schistosomiasis which was indicative of the epidemicity of the disease particularly in large stagnant water bodies and marshy free grazing areas. The prevalence of Schistosoma infection has reported from different regions of the country by faecal examination. For example, 33% was reported by [10], 12.3% was reported by [5], 34% was reported by [11], 17.4% was reported by [12], 22.06% was reported by [13], 37.3% was reported by [14] and 24.3% was reported by [8] in and around Bahir Dar and 27.13% in Dembia district reported by [15] and also 10.17% in fogera district resulted by [16].

Even though these works have been done, it is important to have current information on the prevalence of the disease. Therefore, this study was carried out mainly:

- To estimate the prevalence of bovine Schistosomiasis in and around Bahir Dar town
- To identify the possible risk factors for the occurrence of the disease.

**MATERIALS AND METHODS**

**Study Area:** The study was conducted from October, 2014 to April 2015 in and around Bahir Dar Town Which covers a total of 217,995 hectares of land. The study area is located 11°37’N latitude and 37°25’E longitude with altitude of 1500-2300 m.a.s.l.1786-1886 m.a.s.l., annual rain fall of 1200-1600 mm and mean annual temperature of 29.5°C. About 70% of the land is featured by plain plateaus and covered by various bush formation of low woods mainly every green lands and some semi-humid and humid highland vegetation, with major agricultural products like teff, wheat, sorghum, maize and pulse crops. The landscape is marked by the presence of Lake Tana, which drains a water shed of about 3,000 km² and areas adjacent to Lake Tana and Abay River have poor drainage and annual over flooding during the rainy season months leaving pockets of water bodies for long period during the dry season. The human population of the town is about 170,000 [17].

**Study Animals:** The sampling units of the study were cattle of different breed, age, sex, body condition and were managed in different management systems that were found in and around Bahir Dar town. Cattle in the town are used for milk production for commercial use and are mainly cross breeds of Holstein Frisian with that of indigenous breeds, while those around the town are mostly indigenous breeds used for breeding purpose to produce draught oxen. This study includes both sex of cattle and their age groups as well as local and cross breeds of cattle and also different body conditioned cattle. The cattle in this area were kept mainly under (extensive), semi intensive and intensive management systems.

**Study Design and Examination Methods:** It was a cross sectional study design, conducted on local and cross breed cattle to estimate the prevalence of bovine schistosoma infection and its associated risk factors in and around Bahir Dar town from October, 2014 to April, 2015. Breed, age, sex, body condition score and management system were considered as potential risk factors to affect occurrence of Schistosoma infection to be tested. Based on their age, study animals were grouped in to three groups as calves <=2 years of age, adult = 2-5 years of age and older cattle =>5 years of age [18]. Based on body condition score, they were also grouped into three as poor, medium and good body conditioned as described by [19]. Based on their breed, study animals
were grouped into local and cross breeds. According to the system the animals were kept, the management system was grouped into extensive, semi intensive and intensive management systems. Based on the topography, the study area, Bahir Dar and the area around Bahir Dar, was grouped into three and the sample size was proportionally distributed to each of the three selected study sites.

Schistosoma infection was measured by coprological examinations which were collected from randomly selected animals. An animal was recorded as positive for schistosoma infection if one or more schistosoma eggs were found in its faeces by the coprological examination. First the history of the animals was taken from their owners about previous treatment, management system and feeding practice and then samples of fresh faeces were collected directly from the rectum of the cattle. Then the collected samples were preserved by 10% formalin in a universal bottle with proper labeling of every necessary information and then transported to Bahir Dar Animal Health Diagnostic and investigation laboratory. Then, the samples were examined by using sedimentation technique. The sedimentation technique is a qualitative method for detecting the parasitic eggs that have high specific gravity within the faecal/water suspension, then; the eggs were identified as follows.

- About 3 g of faeces were taken in to container 1.
- Poured 40 ml of water and mixed them thoroughly.
- Filter the suspension through a tea strainer into container 2.
- Left it for 15 minutes.
- Decant the supernatant and added water then left for 15 minutes (repeated this step 3 times).
- Thereafter the sediment was taken by using the pipette and added on a clean slide.
- Examined under a low power microscope (10x).

Sample Size Determination and Sampling Method: The sample size was determined by using the formula given by [20] set for random sampling for infinite population. Therefore using 95% confidence level, 5% desired absolute precision and 24.3% expected prevalence [8], the number of cattle included in the study was determined by using the formula below.

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 n = \frac{(1.96)^2 \cdot p_{exp} \cdot (1-p_{exp})}{d^2}
\]

Where: 
- \( n \) = required sample size 
- \( p_{exp} \) = expected prevalence 
- \( d \) = desired absolute precision

By using the formula, the number of cattle included in this study was 283. But to generate reliable data and to increase the precision, the sample size was increased to 354 to include more cattle. Simple random sampling method was applied to select study animals. During sampling of the animals, their breeds, age groups, sex, body condition score and management system were recorded. On this study 354 samples were collected randomly from local and cross breed of cattle, from both sexes of animals as well as from cattle that were grouped under different age groups, from different body conditioned animals and also from animals that were kept under different management systems and the three study areas were randomly selected among all kebeles of Bahir Dar town and surrounding areas by using lottery system. This sample size was proportionally distributed to the three selected study areas to avoid biasness and to assess the prevalence of the disease in each selected site.

Data Analysis: The data was entered into Microsoft excel Data base and analyzed using SPSS statistical soft ware programs version-16. The overall prevalence of the disease was calculated by dividing the number of positive animals to the total number of examined animals, which is expressed in percent. Pearson’s chi-square (\( \chi^2 \)) was used to evaluate the association between the prevalence of schistosoma infection with various possible risk factors. In this analysis p-value less than 0.05 at 5% level of significance were considered as statistically significant.

RESULTS

The prevalence of Schistosomiasis in bovine was investigated based on the presence of *Schistosoma bovis* in the faecal samples. Out of the total 354 faecal samples examined, 93 (26.3%) samples were found to be positive for schistosoma eggs.

The prevalence of Schistosoma infection was compared between different groups of animals. When the prevalence of the disease was compared between animals of different body condition, origin of sampled animals and management system, there was statistically significant difference. However, there was no any statistically significant difference in prevalence between local and cross breeds of cattle, among different age groups and between sex groups of study animals.

When the prevalence of Schistosoma infection was compared between animals of different origin, the highest prevalence was observed in Sebatamite (37.3%) followed by kebele nine (28.0%) and Zenizelima (13.6%) and also there was statistically significant difference among the prevalence (p<0.05) (Table 2).
The prevalence of bovine schistosomiasis was higher in local breed cattle (27.5%) than cross breed cattle (21.8%) (Table 3). However, there was no statistically significant difference in prevalence of Schistosoma infection between the two groups of breeds of cattle (p<0.05) (Table 3).

When the prevalence of schistosoma infection in the two sex groups of animals was compared, the prevalence in females (27.8%) was higher than that of prevalence in males (24.4%). However, there was no statistically significant difference between the prevalence of both sexes (P > 0.05) (Table 4).

The highest prevalence of schistosoma infection was observed in cattle of 2 to 5 years of age (28.7%) followed by those older than 5 years while the lowest prevalence was observed in cattle of less than 2 years of age. However, there was no statistically significant difference in prevalence among the different age groups of cattle (P> 0.05) (Table 5).

The prevalence in poor body conditioned animals (36.8%) was the highest followed by that of medium body conditioned animals while the lowest was in that of good body conditioned animals and the prevalence was statistically significant.
(p<0.05) among animals of different body conditions (Table 6).

When prevalence of schistosoma infection was compared in animals of different management system, the highest prevalence was observed in cattle kept under extensive management system (30.3%) than semi intensive management system (16.7%), while the lowest was observed in animals kept under intensive management system (Table 7). However there was no statistically significant difference in prevalence among animals in different management system (p<0.05).

**DISCUSSION**

The overall prevalence of schistosoma infection in the study was 26.3%. The result obtained in the current study was almost comparable with the work of [8] who reported schistosoma infection in cattle with prevalence of 24.3%. However, bovine schistosoma infection has been reported with prevalence of higher and lower than obtained in the current study. It was higher than the prevalence reported by [12, 13], who reported bovine schistosoma infection with prevalence of 17.4, 10.93 and 22.06, respectively. Whereas the prevalence of current study was lower than the prevalence reported by 34% [11], 37.3% [14] 27.13% [15] ; as stated earlier prevalence of 37.3% was reported [14] schistosoma infection might be associated with the method followed in the different studies including the current study; it can be related to coprological examination or in the sampling strategy while selecting study sites; difference in the sampling season in different studies or change in prevalence of schistosoma infection in different study years.

The higher prevalence of bovine schistosoma infection was observed in local breed cattle (26.3%) as compare to cross breed cattle (21.8%) (Table 3), this might be associated with the difference in exposure to natural infection. Cross breed cattle were kept for milk purpose; so the exposure of this group was less than that of the local breed, because the former group were kept in intensive management system while the latter group were kept in extensive management system. This might be due to local breeds were repeatedly exposed for natural infection. The difference was not statistically significant (p>0.05). In support of this study [8] reported higher prevalence of schistosoma infection in local breed cattle (24.9%) than the prevalence in that of cross breed cattle (18.5%). However (14) [14] reported higher prevalence of schistosoma infection in cross breed cattle than in local breeds in the same study area.

The prevalence of schistosoma infection in both sex groups was almost similar and was not statistically significant difference (p>0.05). It is unrealistic suggestion that the physiological difference between the two groups of cattle had no impact to affect the occurrence of schistosoma infection; rather, the observation for this variable might be not enough to show the difference or more positive or more negative animals might be considered in either or both of the sex groups to affect the study by chance. Even though this might be due to both sex groups were grazing in similar Schistosoma contaminated pasture land and water points that are highly susceptible to the risk of acquisition of the infection. Therefore, the disease appeared to be well distributed among the two sexes.

According to the age group, the prevalence of Schistosoma infection in this study was the highest in age group of cattle between 2 to 5 years (28.7%) followed by the age group with greater than 5 years of age (26.1%) and it was the least in age group of below 2 years (17.1%). However, the difference in the prevalence among the three age groups was statistically non-significant (P>0.05). This could be attributed to the fact that adult and old cattle groups cover large areas and have high grazing capacity than young age groups under extensive and semi intensive management system where, the prevalence of cercaria infection is predominated. But, calves may not be weaned up to an average of 2 years and do not graze on the field with adult cattle rather, they are kept indoor. So they have low probability to be exposed for the disease. The prevalence of the disease was slightly lower in older age group of cattle than adult age group of cattle. It might be due to the development of acquired resistance against the parasites, which could suppress the worm fecundity and decrease the release of parasitic eggs within the faeces [21]. This result agrees with the work of [8] who reported as 29.16, 21.47 and 19.35% in ascending order of age groups respectively. However, it is contrast to the report of [16] who reported the prevalence as 14, 10.9 and 5.4% for the age groups of <2 year, 2-5 year and >5 year, respectively.

As this result indicated that the highest prevalence of Schistosoma infection was observed in Sebatamite (37.3%) as compared to that of kebele nine (28%) and Zenzelima (13.6%). The variation was also statistically significant (p<0.05). This might be associated with the difference in environmental factors and the nature of the areas. The moisture was high in Sebatamite and its swampy nature that might give more favourable condition for the multiplication of intermediate host,
hence the schistosoma infection and give more chance of infection to occur. As described by [3]; marsh areas and stagnant water bodies like small streams, ponds, swampy areas around rivers and lakes and in irrigation sites can act as source of infection for Schistosomiasis.

The statistical analysis of this study showed that body condition score had significant influence on the prevalence of bovine schistosomiasis in the area. The highest prevalence was observed in cattle of poor body conditioned (36.8%) followed by medium body conditioned cattle (19.7%); while the lowest was observed in cattle with good body conditioned (10.6%). There was statistically significant difference (p<0.05) among in different body conditioned cattle. This result agreed with the report of [8, 11]. It might be associated with the level of immunity; when an animal has poor body condition, its protein to synthesise antibodies and the whole physiological system doesn’t work mechanisms as normal. In addition to this, when an animal has got its body poor by any other problem, owners gave more emphasis for the animal as sick to compensate their poor body condition score. As it is true in everywhere, the owners get green grass particularly during the dry period from marshy areas where the snail and the infective stage of parasite is likely to be high; so the owners might increase the chance of exposing the poor body conditioned animals while giving the green grass contaminated with the parasite.

The prevalence of bovine schistosoma infection was highest in cattle that were kept under extensive management system (30.5%) followed by cattle kept in semi-intensive management system (16.7%) and the lowest prevalence was observed in cattle that were kept under intensive management system (10.0%) with statistically significant difference (P<0.05). This result is agreed with [15]. Animals belonging to the extensive management system stay in the field grazing throughout the day so have more chance of exposure to schistosoma infection as compared to the two other management systems. The chance of exposure is relatively less in semi-intensive management system by similar reason. Intensively managed animals might also be exposed to the parasite when animals are fed with feed contaminated with the infective larvae. However, even though, the chance is there; the farmers did practice feeding green feed less frequently and fed grass in the form of hay which is dry so the chance of the infective larvae to resist the drying and infecting the animals with the hay is very unlikely.

CONCLUSION AND RECOMMENDATIONS

The prevalence of bovine schistosoma infection recorded in this study revealed that bovine schistosoma infection was endemic in the study area. Schistosoma infection can cause significant economic losses throughout the world. The disease was one of the major parasitic diseases contributing to loss in productivity and production of cattle in the study area. Higher prevalence of schistosoma infection was observed in local breed cattle than the cross breeds. The highest prevalence of schistosoma infection was observed in cattle managed in extensive management system, in poor body conditioned cattle, in Sebatamit and in cattle of 2-5 years of age followed by cattle managed under semi-intensive management system, in medium body conditioned cattle, in Kebele 9 and in cattle of older than 5 years of age while the lowest prevalence was observed in animals kept under intensive management system, in cattle of good body condition, in Zenzelima area and in cattle less than 2 years of age, respectively. By the current study, schistosoma infection was similar between male and female cattle. Based on the present study the following recommendations are forwarded as related to the existing reality of the study area.

- Schistosoma infection should be taken into consideration as one of the limiting factor for livestock productivity in and around Bahir Dar town.
- Direct killing of intermediate host; snails with chemicals or destroying their habitats through drainage system should be implemented. The native Ethiopian plant *Phytoplanccadodecandra*, locally known as “*Endod*” which is considered as potent molluscicide for the control of human Schistosomiasis, should be also effectively used against intermediate host of bovine Schistosomiasis.
- Farmers’ awareness should be created to reduce exposure of their animals particularly those who are using extensive management system, keep local cattle and feeding green grass to their poor body conditioned animals in Sebatamit.
- Further research and designing economically feasible and practically applicable control strategy should be encouraged regarding to schistosoma infection.

REFERENCES