Acta Parasitologica Globalis 5 (1): 01-06, 2014
ISSN 2079-2018

DOI: 10.5829/idosi.apg.2014.5.1.81135

Bovine Schistosomiasis: A Threat in Public Health Perspective in Bahir Dar Town, Northwest Ethiopia

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Abstract: A cross sectional study was conducted from November 2011 up to March 2012 in and around Bahir Dar Town, North-West Ethiopia, to determine the prevalence of *bovine schistosomiasis* and risk factors. Simple random sampling was used to select the study animals and coprological examination and abattoir examination. A total of 400 cattle were examined, 300 cattle for field survey and 100 cattle for abattoir survey. From the 300 cattle, 24.3 %(n=73) were found positive for *schistosoma bovis* on Coproscopic examination. The prevalence of schistosomosis was found higher in poor body condition cattle (68.88%) than that of medium (17.54%) and good body condition (11.36%) cattle. There was also statistically significant difference (x^2=57.834, p=0.000). The prevalence of the disease was higher in local breed cattle (24.9%) than that of cross breed cattle (local x Holstein-Friesian) (18.5%). The prevalence of the diseases in extensive management system is higher (25.2%) than that of semi intensive management system (15.38%). However, it has no statistically significant difference (x^2=1.635, p=0.201) between the two management systems and breeds. In the second parts of the study, 100 cattle slaughtered at Bahir Dar municipal abattoir were examined. Of these 22% (n=22) harbored *Schistosoma bovis* in their mesenteric and portal vein and 10% (n=10) in coproscopic examination of slaughtered cattle. Therefore, Schistosomosis should be taken in to consideration as one of the major limiting factor to live stock productivity in and around Bahirdar Dar. Hence, control measures against schistosomiasis must be designed to target either the parasite or the snail intermediate host.

Key words: Prevalence · Coproscopic · *Schistosoma Bovis* · Bahir Dar · Ethiopia

INTRODUCTION

Schistosomes are dioecious parasitic flatworms, which live in the vasculature of their mammalian definitive hosts. They are the causative agent of schistosomiasis, a disease of considerable medical and veterinary importance in tropical and subtropical regions [1]. Schistosomosis is a chronic debilitating infection affecting both humans and animals by different species of schistosomes and hence the disease is of public health importance. Other names given to Schistosomosis are blood fluke disease and Bilharziasis [2].

The schistosomes are different from most other members of the digenea in that the sexes are separate. The term schistosomes or schistosoma means split body and refers to the fact that the males have a ventral groove called gynaecophoric canal [3, 4]. Schistosomes are thin, elongated fluke, up to 2 cm long primarily parasitize in blood vessels of alimentary tract and bladder [5] responsible to cause Schistosomosis, which is a common parasitic infection in Africa and Asia.

Although these parasites occurs in many tropical and sub tropical areas, the disease is important in livestock mainly in Eastern Asia, Africa and India. Schistosomosis is one of the major diseases of man in tropics [6-8]. The distribution of Schistosomosis varies from places to places. Example: *S.bovis* the commonest species in Africa and Mediterranean region [9, 10]. However, *Schistosoma spinale, S. insium* and *S. nasalie* have been reported as the major causes of Schistosomosis in Asia [11, 12]. *Bulinus, Indoplanorbis* and *Glanorbi*d snail intermediate hosts are transmitting schistosomes to cattle [13, 14].

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Though Ethiopia is recognized for its vast wealth of livestock, the economic benefit derived from the livestock center does not commensurate with the potential [15]. Development of large animal is constrained among other important factors, by wide spectrum of the diseases like Schistosomosis. In our country, Schistosomosis appears to be spreading. The major transmitting sites are small streams all over the highlands of Ethiopia, lakes like Tana, Zeway as well as irrigation systems, such as sugar state Wonji do also play a similar role [9].

Few and limited studies have been carried out with regard to bovine Schistosomosis in and around Bahir Dar town who reported various prevalence based on Coproscopic examination. Nevertheless, there was no any recent data about the status of the disease in the study area. Moreover, detailed epidemiological data with regard to associated risk factors was scanty. Therefore, this study was carried out mainly to determine the prevalence of bovine Schistosomosis and to identify the risk factors associated with bovine Schistosomosis in and around Bahir Dar Town.

MATERIALS AND METHODS

Study Area: The study was conducted from November 2011 to March 2012 in and around Bahir Dar Town Which covers a total of 217,995 hectares of land. Bahir Dar town is found 570 km away from Addis Ababa, North western part of Ethiopia. The study area was located 11°29'N latitude and 37º29'E longitude with an altitude of 1500-2300 m.a.s.l., annual rain fall of 1200-1600 mm and means annual temperature of 29.5°C. About 70% of the land is featured by plain plateaus and covered by various bush formation 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 km^2 and areas adjacent to Lake Tana and Abay River have poor drainage and annual over flooding during the dry months. The total number of cattle population in Western Gojjam Zone was 1,800,917 [16].

Study Design: A cross-sectional study design was used and conducted to determine the prevalence of Bovine schistosomiasis and its risk factors in and around Bahir Dar Town from November 2011 to March 2012.

Sample Size Determination: The desired sample size was calculated using the formula given by Thrusfied [17], with 95% confidence level,5% desired absolute precision and 22.06% expected prevalence [18] study 263 cattle were selected using simple random sampling method to estimated the prevalence of the disease. However, due to low number of positive animals at the beginning of the study by using the formula

$$\frac{n=1.962 \times pexp\ (1-pexp)}{d2}$$

Where, n=required sample size.

P_{exp} =expected prevalence.

$_d{}^2$=desired absolute precision. The sample size was increased to 400 cattle.

Study Population: The sampling unit of the study was local and cross breed cattle. Both traditional and modern (semi-intensive) managements are practiced in the study area. Both breeds were used in the field Survey while only local ones examined under abattoir survey that originated from Achefer, Adet, fogera, Estie and Around Bahir Dar. The age of the study animals was determined by dental eruption formula which involves counting a number of permanent incisors [19].

The study animals were formed based on age were designated as follow; Age group: $0<x<2$ years; $2\leq x\leq 5$ years; $x> 5$ years; where x=year of animals. The dominant cattle breed in the region was local indigenous zebu cattle as well as fogera breed. In the study area both traditional and modern (semi-intensive) livestock farming system are practiced. The traditional management systems are often kept out and grazed all day near the vicinity of the Lake Tana. These grazing areas are potential source of schistosoma infection due to the frequent contact of animals to the water bodies. In semi-intensive management system, cattle are kept in doors and partly out-door. While indoors, they are supplemented with adequate qualities of food and clean water.

Data Collection: Fresh fecal samples were directly collected from the rectum of 300 cattle in the field and the samples were preserved in 10% formalin in a universal bottle to prevent hatching of miracidia. Then, the eggs were concentrated through sedimentation procedure and were observed under low power microscope in the laboratory.

Fecal samples were collected before slaughter from each animal during ante-mortem examination with the universal bottles and were examined for the presence of schistosoma eggs.

Post-mortem examination of the portal vein and mesenteric veins were undertaken to find the adult schistosomes and to appreciate the presence of lesions and dead parasites [20].

Data Analysis: The data were first entered into Microsoft excel Data base and was analyzed using SPSS 16 Statistical software program. The prevalence was calculated by dividing number of positive animals by total number of animas tested. Pearson's chi-square (x^2) was used to evaluate the association between the prevalence of different cattle diseases with various risk factors p-value less than 0.05 at 5% level of significance were considered significant in this analysis.

RESULTS

Of the total 400 cattle, 300 were examined using coproscopical examination in the field survey; accordingly 73(24.3%) were found to be positive for *schistosoma bovis*.

The relationship between the various risk factors with the prevalence of bovine schistosomiasis is shown in table 2; accordingly, the prevalence of schistosomiasis was higher in local breed cattle (24.9%) than that of cross breed cattle (local x Holstein-Friesian) (18.5%); in female cattle (25.9%) than that of male (22.4%), in extensive management system (25.2%) than that of semi-intensive management system (15.4%) and it was higher in age group of cattle above 2 years and below 5 years of age (29.2%) than that of age group of below 2 (19.4%) years and above 5 years (21.5). However, the difference between the two breed, sex, management system and among the age groups was not statically significant (P>0.05).

According to the body condition, the prevalence in poor body condition was higher than that of medium body condition as well as good body condition and the variation was statistically significant (P<0.05) (Table 2).

In the abattoir survey, fecal sample was collected for coproscopical examination from 100 cattle before slaughter during ante mortem examination. In addition, post mortem examination of portal and mesenteric vein of each animal was under taken. The result of the abattoir survey should that 22(22%) were positive for *schistosoma bovis* in post mortem examination where as only 12(12%) were positive for coproscopical examination. Kappa was calculated to see the agreement of the two tests; thus, there was moderate agreement between post mortem and coproscopical examination (K_{appa}=0.65).

According to the body condition score, all slaughtered cattle were categorized in to medium and good. Hence, the prevalence was higher in those animals with medium body condition; however the difference was not statistically significant (P> 0.05) (Table 3).

The highest prevalence was recorded in cattle originating from Achefer and the lost in cattle originating from Tachgaint and there was statistically significant variation between abattoir based prevalence and the origin of slaughtered animals (p<0.05) (Table 3).

Table 1: The prevalence of bovine Schistosomosis in different breed, sex, age group, body condition and management system.

Risk factor		No of cattle Examined	No of positive cattle Prevalence (%)	x2	p-value
Breed	local	273	68(24.9)	1.31	0.253
	Cross	27	5(18.5)		
Sex	male	138	31(22.4)		
	Female	162	42(25.9)	0.49	0.486
Age	0<x<2	31	6(19.4)		
	2<x<5	120	35(29.2)	1.56	0.456
	x>5	149	32(21.5)		
Body condition	poor	45	31(68.88)		
	Medium	211	37(17.54)	57.83	0.000
	Good	44	5(11.36)		
Management	extensive	274	69(25.2)	1.64	0.201
	Semi intensive	26	4(15.4)		

Table 2: Prevalence of the disease in different body condition of slaughtered cattle

Body condition	No. animals Examined	No. of positive animals prevalence (%)	X^2	p-value
Medium	70	18(25.71)	2.740	0.254
Good	30	3(10)		

Table 3: Prevalence of bovine schistosomosis according to the origin of slaughtered cattle

Study origin	No. animals Examined	No. of positive animals prevalence (%)	X2	p-value
Achefer	12	7(58.33)		
Bahir Dar	19	4(21.05)		
Fogera	17	4(23.52)	12.490	0.029
Estie	24	4(16.66)		
Adet	20	3(15)		
Tachgaint	8	0(0)		

DISCUSSION

The overall prevalence of *Schistosoma bovis* infection found in this study is (24.3%, n=73) which is almost similar with other studies done previously in and around Bahir Dar 33% [21], 34% [22], 17.4% [23] & 22.06% [18] and 27.13% in Dembia district by Alemseged [24]. This might be due to the fact that most of the area in and around Bahir Dar Town has wide swampy pastureland that creates an appropriate environment for the intermediate host (Snail). Moreover, significant number of cattle is slaughtered through backyard system and consequently, the stomach and intestinal contents including the blood and washed material are usually dumped in to the nearby water bodies (Rivers, irrigation, canals and ponds etc). These could create an easy access for the egg of schistosoma from such animals to enter in to the snail intermediate host. In addition to the above problems, the hygienic status of Bahir Dar municipal abattoir is so poor that it also contributes to the distribution of such diseases. Besides, the traditional livestock management system of the cattle owners in the study area as well might play its own role for the prevalence of the disease.

Specifically over all prevalence of our study is lower than the previous studies reported by Haile 33.8% [21], & Hailu 34% [22] in and around Bahir Dar as well as Alemseged [24], 27.13% in Dembia district. This could be due to the policy change towards urban husbandry practices in Bahir Dar, which is the capital city of the Amhara Regional State of Ethiopia. The agricultural office of the city is following and encouraging intensive and semi-intensive management system that reduces the exposure of the animals to the marshy areas.

The result of coproscopical and post mortem examination conducted in this study (12% and 22% respectively) is virtually in accord with the previous study carried out by Almaz [25] that was 10.93%, 28.14% by Solomon [18], 10%, 27% in and around Bahir Dar by Alemseged [24], 12%, 30% in Dembia district respectively. The lower prevalence of schistosomosis recorded using coproscopical as compared to post mortem examination may be related to the reality that adult parasites established in the mesenteric veins and the stage of infection may determine fecal egg output. As described by Lawrence [26] immunity did not act primarily by absolute prevention of maturation of challenge infection, but mainly by suppression of worm fecundity. Thus post mortem examination is more sensitive in detecting schistosoma infection than coproscopical examination.

Although the prevalence of bovine schistosomiasis in our study was a bit higher in local breed cattle (24.9%) than that of cross breed cattle (18.52%), the difference was not statistically significant ($P>0.05$). In support of our work, Alemseged [24] recorded prevalence of 29.68% in local breed and 17.14% in cross breeds in Dembia district. This might be due to less exposure of the animals to the marsh areas and to the cercaria. In contrast to our finding, Solomon [18] in and around Bahir Dar reported higher prevalence (25.83) in cross breed cattle than that of local cattle (16.66%).

According to the age group, the prevalence of schistosomiasis in this study was the highest in age group of cattle between 2 to 5 years (29.16%) followed by that to the age group with greater than 5 years of age (21.47%) and it was the least in age group of below 2 years (19.35%). However, the difference in the prevalence among the three age groups was not statistically significant ($P>0.05$). This finding agrees with the work of Alemseged [24], who reported 17.60% in those ages group below 2 years; 30.10% in age between 2 and 5 years and

27.80% above 5 years in Dembia district. While this results disagree with (27) who reported that the prevalence of the disease is dependent on age and it is for the reason that cattle less than 2 years old has highest prevalence since to immunity to resist the new infection than others.

The variation in the prevalence between two sexes 22.25% in male and 25.92% in female was not statistically significant p>0.05). This is in accord with previous study of Solomon [18], 29.61% in female and 19.54% in male in and around Bahir Dar as well as Alemseged [24] 30,70% in female and 23.30 % in male in Dembia district.

The prevalence of bovine schistosomiasis was higher in extensive management system (25.18%) than that of semi-intensive management (15.38%). However, the difference was not statistically significant (P>0.05). This finding was agreed with Alemseged [24]. Obviously, animals belonging to the extensive management system are more exposed to schistosomiasis than those animals kept in door.

In agreement with Hailu [22] and Haile [21] the prevalence varies among the body condition of cattle in field survey. Hence, it was high in poor body condition (68. 88%) than that of medium (17. 54) and good (11.36%) body conditions and the variation was statistically significant (P< 0.05). The reason may be related to the body defense mechanism of cattle. As described by Lawrence [26]; immunity did not act primary by absolute prevention of maturation of challenge infection, but mainly by suppression of worm fecundity.

Cattle that were slaughtered in Bahir Dar municipal abattoir were originated from different areas of the region accordingly, the prevalence of the disease from cattle that originated around Achefer (58.33%) was the highest of all whereas, the least prevalence was observed in cattle that originated around Tachgaint (0%). The difference in the prevalence among the cattle from various origin was statistically significant (P<0.05). The reason may be due to whether the areas are swampy and marshy. As Bedarkar [28] marshy area was suitable for the survival of its intermediate host and the parasite itself.

CONCLUSIONS

The outcome of this study strongly suggests that bovine schistosomiasis is one of the endemic diseases in the study area that deserves serious attention. Cattle schistosomiasis cause significant economic loses throughout the world. This is due to the nature of the disease. There for, it is important to obtain more information on natural schistosoma infection in cattle in general and on the evaluation of the host-parasite relationship under conditions of challenge in particular season had great role for disease rate of infection.

Based on this study, the following recommendations are forwarded:-

- Schistosomosis should be taken into consideration as a one of the major limiting factor to livestock productivity in and around Bahir Dar Town; hence any endeavor towards animal disease control strategy must include it in the priority list.
- Care must be taken when treatment was administered because over dose results for other complications.
- Farmers should in need of awareness about the risk factors and its transmission at least to tell them not to graze their cattle freely in swampy areas and to supply dry feeds sometimes.
- Measures should be taken to minimize the risk of schistosomiasis either by directly killing of fresh water snails by poisoning or by destroying their habitats by removing water side vegetations.
- Human being after swimming must be washed their bodies with soap and dry with clean towel.
- Further detailed studies are needed to gather a rich database both on the parasite and its vector, which will be useful to envisage a cost effective and sound schistosomiasis control measure in the area.

ACKNOWLEDGEMENTS

We would like to thank University of Gondar, Faculty of Veterinary Medicine for the grant provided to us to do this` research. We wish also to express our profound gratitude to personnel of Addis Ababa Abattoir Enterprise for their unreserved guidance, valuable suggestions and voluntariness to do this research.

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