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Study on Prevalence and Associated Risk Factors of Bovine and Human Schistosomiasis in Bahir Dar and its Surrounding Areas

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ABSTRACT

The study was conducted from November 2010 to March 2011 in Bahir Dar and its surrounding areas, north-western Ethiopia, to determine the prevalence of Bovine schistosomosis and its associated risk factors. A cross sectional study was conducted on coproscopical, abattoir examination to bovine schistosomosis and retrospective study three years health institution record to assess human schistosomiasis. 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 for schistosoma bovis on coproscopic examination. The prevalence of schistosomosis with regarded to body conditions was found 10.3% (poor), 12.3% (medium) and 1.7% (good) and has also statistically significant difference (p= 0.00). The prevalence of the disease was higher in local breed cattle (24.9%) than cross breed cattle (Local x Holstein-Friesian) (18.52%). The prevalence of the disease in was higher in extensive management system (25.18%) than semi-intensive management system (15.38%). However it has no statistically significant difference (P=0.201) between the two management systems. In the second part of the study, 100 cattle slaughtered at Bahir Dar municipal abattoir were examined. Out of these 22 % (n=22) harbored Schistosoma bovis in their mesenteric and portal veins and 10 % (n=10) in coproscopic examination of slaughtered animals. In the third study the infection rate of S. mansoni in human the rate decreases in three consecutive years (2000, 2001, and 2002; 45.1%, 37.0% and 9.8%) respectively. The rate of schistosomiasis was highest in young people (69.0%), adult (15.3%) and old people (7.5%).

Keywords: Coproscopic, prevalence, risk factors, schistosomiasis, *Schistosoma bovis*

Schistosomosis is an infection due to trematodes of the genus schistosoma. The taxonomic classification of the organism that causes schistosomiasis is presented as phylum platyhalminthes, class trematoda, sub class Digenea, super family schistomatidea, Genus schistosoma and species *S.bovis*, *S.matheei*, *S .mansoni*, *S.hematobium*, *S.nasalis*, *S. spindalis* (Rollinson and Southgate, 1993). 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. Adult Schistosomes are obligate parasite of blood vascular system of vertebrates.

Although these parasites occurs in many tropical and sub tropical areas, the disease is important in livestock mainly Eastern Asia, Africa and India. Schistosomosis is one of the major diseases of man in tropics (Sewell and Brockebsy, 1990; Wu and Halim, 2000). Other names given to schistosomosis are blood fluke disease and Bilharziasis (Parija, 2004). The schistosomes are different from most other members of the Digenea in that the sexes are separate. The term schistosome or schistosoma means split body and refers to the fact that the males have a ventral groove called gynaecophoric canal (Urquhart *et al.*, 1987; Marquardt and Greives, 2000).

In Ethiopia livestock represents major national resource and form an integral part of the agricultural production system. The country has the largest population of African countries with an estimated 35 million tropical livestock units (TLU). Though Ethiopia is recognized for its vast wealth of livestock, the economic benefit derived from the livestock center does not commensurate with the potential (FAO 1993). 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 (Shibru, 1986).

Schistosomes are thin, elongated fluke, up to 2 cm long primarily parasitize in blood vessels of alimentary and bladder (Urquhart *et al.,* 2003) responsible to cause schistosomosis. Schistosomosis is common parasitic infection in Africa and Asia. The distribution of schitosomosis varies from to places to places. Example: *S.bovis* the commonest species in Africa and Mediterranean region (Shibru *et al.,* 1989). However, *Schistosoma spindale, S. insium* and *S. nasalie* have been reported as the major causes of schistosomosis in Asia (Fisher and Say, 1989; Bont, 1995). *Bulinus, Indoplanorbis* and *Glanorbid* snail intermediate hosts are transmitting schistosomes to cattle (Lo and Lemma, 1983; Solomon, 1985). Few and limited studies have been carried out with regard to bovine schistosomosis in and around Bahir Dar 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. Prevalence, associated risk factors of bovine schistosomosis and status of human schistosomosis in the study area was determined in the present course of inverstigation.

MATERIALS AND METHODS

The Study Area

The study was conducted from November 2010 to March 2011 in and around Bahir Dar which covers a total of 217,995 hectares of land. Bahir Dar is found 570 km away from Addis Ababa, North western part of Ethiopia. The study area was located 11º 29'N latitude and 37º 29'E. Longitude with an altitude of 1500-2300 m.a.s.l., annual rain fall of 1200-1600 mm and means annual temperature of 29.5ºC. 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 (CSA 2008).

Animals and Managements

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-doors and grazed all day near the vicinity of the Lake Tana. These grazing areas are potential source of schistisoma 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.

Study Population

The sampling units of the study were 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, Adate, 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 (De-lahunta and Hable, 1986).

The Study animals were formed based on age were designated as follow:

Age group	
Group 1.	0<_x<2 years
Group 2.	2<_x<_5 years
Group 3.	x>5 years

Sampling Design

Across sectional study was conducted to determine the prevalence of Bovine schistosomosis and its risk factors. The desired sample size was calculated using the formula given by Thrusfied (2005), with 95% confidence

level,5%desired absolute precision and 22.06% expected prevalence (Solomon, 2008) 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:

$$N = \frac{1.96^2 \times P_{exp}\left(1 - P_{exp}\right)}{d^2}$$

N = required sample size.

P_{exp} = expected prevalence.

d^2 = desired absolute precision.

The sample size was increased to 400 cattle. For retrospective study, consecutive three years secondary data was collected from human health institution.

Study Methodology

Coproscopic Examination

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.

Post-mortem Examination

Fecal samples were collected before slaughter from each animal during ante-mortem examination with the universal bottles and were examined for the presence of shcistosoma eggs. Post-mortem examination of the portal veins and mesenteric veins were undertaken to find the adult schistosomes and to appreciate the presence of lesions and dead parasites (Urquhart *et al.,* 1997*).*

Retrospective Study

Human Schistosomiasis

Schistosome is one of a treamatode parasite of humans and animals. This trematode parasite (schistosoma) has different species At least 19 species of schistosome are recognized though only few are pathogenic to man and domestic animals (Domo and Kela, 2009). I have already taken recorded data in different health center and the known referral hospitals to know the status of the disease in human beings, because the disease has great economic losses directly and indirectly. Based on Ethiopian government age category of human beings the total recorded data of human beings grouped in to three age groups.

x<_18 years = young

18<x_< 64 years = adult

x>64 years = old

Data Analysis

The total data collected during the studying period were stored on Microsoft (Ms) excel spread sheet program and analysis was done by SPSS Version 16 of SPSS soft ware program. The total prevalence was calculated by dividing number of positive animals by total number of animas tested. Chi-square was also used for data analysis particularly to determine wether risk factors have associated with disease prevalence or not.

RESULTS

Over all prevalence

The total numbers of 400 cattle were examined. From the total of 400 cattle, 300 cattle were examined using coproscopical examination in the field survey 24.3% (n=73) were found to be positive for schistosoma bovis. Of the total of 100 cattle were examined in the abattoir survey, 22% (n=22) were positive for schistosoma female and males worms during post mortem findings but only 12% (n=12) of them were found positive *schistosoma* eggs using coproscopical examination (Fig. A).

Shistosoma bovis eggs were concentrated through sedimentation procedure and were observed under low power microscope in the laboratory. Since the shistosoma eggs were heavy; it sediments at the bottom and the two sharp edge operculated eggs were observed (Fig. 1).

Breed- specific Prevalence

The prevalence of schistosomosis was found higher in local cattle (24.9%) than that of cross breed cattle (Local

× Holstein-Friesian) (18.52%). There was no statistically significant difference (x^2= 1.305, p=0.253) between two breeds (Table 1).

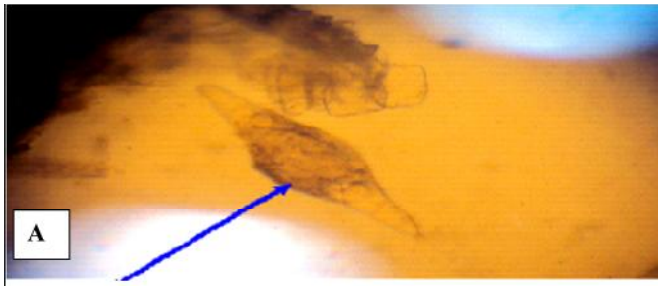

Fig. 1: *Schistosoma bovis* egg from microscopic examination

Age-specific Prevalence

The prevalence of the disease was higher in age group of cattle above 2 years and below 5 years of age (29.16) than that of age group of below 2 years (19.35%) and above 5 years (21.47%). However, no any significance difference (x^2=1.562, p=0.456) among age groups (Table 1).

Sex- specific Prevalence

The prevalence of bovine schistosomosis in female cattle (25.92 %) was found greater than that of male (22.25%). there was also no significance difference (x^2=0.485, p=0.486) between the two sex groups (Table 1).

Body condition-specific Prevalence

The prevalence of bovine schistosomosis in medium body condition cattle (12.3%) higher than that of poor body condition (10.3%) as well as good body condition (1.7%). There was also statistically significant difference (x^2=57.834, p=0.000).

Management system-specific Prevalence

The prevalence of the disease was found higher in the extensive management system (25.18%) than that of semi-intensive management system (15.38%).

Abattoir Survey

A total of 100 male cattle slaughtered at Bahir Dar municipal abattoir were examined; the purpose of this survey was to compare the prevalence difference between post mortem finding and coproscopic examination. During post mortem *Schistosoma bovis* worms were found in the mesenteric and portal veins were examined and incised (Fig. B and C), 22% (n=22) were found to be positive but only 12% (n=12) of that of 100 male cattle were positive in coproscopic examination.

Table 1: Infection prevalence of bovine schistosomosis in different breed, sex, age group, body condition and management system

Risk factors		No. of Cattle examined	No. of positive Cattle Prevalence (%)	X^2 Value	P-Value
Breed	Local	273	68 (24.9)	1.305	0.253
	Cross	27	5 (18.52)		
Sex	Male	138	31 (22.25)	0.485	0.486
	Female	162	42 (25.92)		
Age group	1. 0_<x<2 years	31	6 (19.35)	1.562	0.456
	2. 2<_x<_5 years	120	35 (29.16)		
	3. x>5 years	149	32 (21.47)		
Body condition Medium	Poor	45	31 (10.3)	57.834	0.000
	Medium	211	37 (12.3)		
	Good	44	5 (1.7)		
Management system	Extensive	274	69 (25.18)	1.635	0.201
	Semi-intensive	26	4 (15.38)		

Fig. 2: *Shistosoma bovis* worm in Cattle mesenteric veins

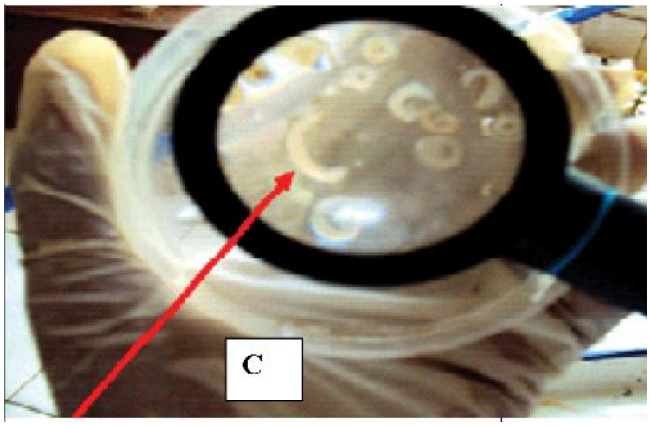

Fig. 3: Adult Schistosoma worms extracted from cattle mesenteric veins *Abattoir*

Body condition-specific prevalence: The prevalence of schistosomosis in medium body condition slaughtered cattle higher than (25.71%) that of good body condition (13.63%) and very good body condition (12.5%) cattle.

Abattoir Origin-specific Prevalence

Cattle were slaughtered in Bahir Dar municipal abattoir come from different origins have difference prevalence. The prevalence of the disease that cattle originated around Achefer (58.33%) higher than from others. The prevalence was low cattle originated around Tachgaint (0%) compared with other origins. It has statistical significance difference (X^2=12.49, p=0.029).

Worm Burden

The numbers of positive slaughtered animals in abattoir have different worm burdens; Mild infected cattle (0-50 number of worms) higher in Percentage (45.45 %) than that of moderate (31.8 %) and highly infected cattle (23.72 %). Also it has statistical significance difference (x^2= 94.246, p=0.000).

Retrospective Study on Human Schistosomiasis

The assessment of human Schistosomosis in Bahir Dar *S. mansoni* was endemic and it has been different rate of infection in 3 consecutive years. The infection rate of the disease was the 45.1%, 37.0% and 9.8% in 2000, 2001 and 2002 respectively. Besides of this the rate was high in young (69.0%) and male humans (59.7).

DISCUSSION

The prevalence found in this study (24.3%) was almost similar with other studies around Bahir Dar (48.3%, 33.8%, 12.3%, 17.4%, and 22.06%) (Solomon, 1985; Hailu, 1999; Yalelet, 2004; Solomon 2008) and 27.13% by (Alemseged, 2010) in Dembia distinct which is due to the reason that most of the surrounding area in and around Bahir Dar have wide swampy pasture land that creates an appropriate environment for the intermediate snail host, as well as most of the slaughtering practice took place in back slaughtering system so that the dumping of the stomach and intestinal contents, including the blood and washed material in the nearby water bodies (rivers, irrigation, canals and ponds etc) can create an easy access to the snail intermediate host to the egg of schistosoma from such animals. In addition to the above problem the Bahir Dar municipal abattoir it self has got hygienic problem that will contribute for the occurrence of the disease and also livestock management system may have role for the prevalence of the disease.

The overall prevalence of *S.bovis* infection 24.3% in the study area was found lower than the previous studies in which the prevalence rate around Bahir Dar were 33.8% (Haile, 1985) and 34% (Hailu, 1999), (Alemseged, 2010)

Table 2: Prevalence of the disease in different months

Months	Total cattle examine	No. of positive cattle	Prevalence (%)	X^2- Value	P-Value
November	78	26	33.33		
December	25	8	32.00	8.508	0.075
January	22	7	31.81		
February	71	14	19.71		
March	104	18	17.30		

Table 3: Prevalence of the disease in different body condition of slaughtered cattle

Body Conditions	No. of animals examined	No. of positive animals Prevalence (%)	X^2 Value	P-Value
Medium	70	18 (25.71)		
Good	22	3 (13.63)	2.740	0.254
Very good	8	1 (12.5)		

Table 4: Prevalence of *bovine schistosomosis* in different origins of the slaughtered cattle

Cattle origins	No. of Cattle examined	No. of positive Cattle prevalence (%)	X^2 –Value	P- Value
Achefer	12	7 (58.33)		
Around Bahir Dar	19	4(21.05)	12.490	0.029
Fog era	17	4 (23.52)		
Estie	24	4 (16.66)		
Adet	20	3 (15)		
Tachgaint	8	0 (0)		

in Dembia distinct. However, this finding was higher than more recent reports 22.06 % (Solomon, 2008) in and around Bahir Dar. The lower prevalence of schistosomosis recorded in his study 22.06 % (Solomon, 2008) may be due to the fact that trematodes are intermittent egg layers so that the chance of detecting eggs by fecal examination may be minimal. In addition to these not all schistosoma eggs are excretes in the faces, many of them may be trapped in tissue (Jones *et al*., 1997). Moreover, the number of adult parasite established in the mesenteric veins and the stage of infection may determine fecal egg out put.

On the other hand coproscopical and post mortem examination was conducted in this study and 12% and 22% prevalence rate were noted respectively which is inline with the previous study carried out by (Almaz, 2007) that was 10.93% in coproscopic and 28.14% in post mortem examination finding, (Solomon 2008) that was 10%in coproscopic, 27% in post mortem examination finding in and around Bahir Dar and (Alemseged, 2010) in Dembia distinct 30% in coproscopic and 12% in post mortem examination was found. The difference in the prevalence of schistosomosis by coprological and post mortem examination, lower prevalence of schistosomosis recorded by examining feces may be related to that adult parasites established in the mesenteric veins and the stage of infection may determine fecal egg out put. As described by (Lawrence, 1979); immunity did not act primary by absolute prevention of maturation of challenge infection, but mainly by suppression of worm fecundity. Thus post mortem examination is more specific to detect schistosoma infection than coprological examination.

In present study prevalence of bovine schistosomosis was higher in local breed cattle (24.9%) than that of cross breed cattle (18.52%). Moreover, there was no significant difference (P>0.05) between the two breeds. This finding is not inline with other reports in which the prevalence of bovine schistosomosis higher in cross breed cattle than that of local cattle (Hailu, 1999); Solomon, 2008), 25.83% in the cross breed and 16.66% in local breeds, but it was agreed with (Alemseged, 2010) in Dembia distinct, 29.68% in local breed and 17.14% in cross breeds. The reason may be due to the cross breed are kept indoor by

Table 5: Percentage of cattle worm burdens in different level of infection

Intensity of infection	Worm Number	No. of animals based on degree of infections	Percentage of positives cattle in worm burden
Mild infected	0-50	10	45.45 %
Moderate infected	50-100	7	31.8 %
Highly infected	>100	5	23.72 %

Table 6: Percentage of *S.mansoni* in human beings in 3 consecutive years

Risk factors and years		*S. Mansoni* percentage (%)	x^2 -Values	P- Values
Sex	Male	59.7	39.57	0.000
	Female	32.3		
Age	Young	69.0	4.80	0.000
	Adult	15.3		
	Old	7.5		
Years	2000	45.1	15.12	0.001
	2001	37.0		
	2002	9.8		

supplementing good feed and clean water so that they can not get access to the cercariea.

The prevalence of schistosomosis in this study which was higher in age group of cattle between 2 to 5 years (29.16%) than that of below 2 years (19.35%) and greater than 5 year of age (21.47%). However there was no any significant difference in prevalence rate among the three age groups. This finding is disagree with other reports (Hailu, 1999) but it is inline with (Alemseged, 2010), 17.60% was found bellow 2 years of age; 30.10% ages between 2 and 5 years and 27.80% was found above 5 years reported in Dembia distinct.

The disease has prevalence variation between two sexes of cattle (22.25%, in male; 25.92% in females), but no any significant difference (P>0.05). It is inline with previous study (Solomon, 2008); 29.61% in female and 19.54% in male in and around Bahir Dar (Alemseged, 2010), 30.70% in female and 23.30% in male cattle was reported in Dembia distinct.

The prevalence of bovine schistosomosis was found higher in extensive management of cattle (25.18%) than that of semi-intensive management cattle (15.38%). However there was no a significance difference between management systems (P=0.201). The reasons for high prevalence in extensive cattle may be due to these animals are kept outdoor.

The prevalence of the disease was not equal in each month. Higher in November (33.33%) where as its prevalence was lower in March (17.30%). Even if the disease has been prevalence variations, there is no statistical significance difference (x^2=8.508, p=0.075) among months. A similar trend was also reported in Chennai (Jeyathilakan *et al.*, 2008), month wise prevalence showed peak in rainy months and low in dry months in case of cattle. Season has great role for the prevalence of the disease (Bedarkar *et al.*, 2008). Moreover, snail densities vary significantly with the season. Most species can survive outside water for short periods (Ling *et al*., 1993).

Cattle that are slaughtered in Bahir Dar municipal abattoir come from different origins have prevalence difference. The prevalence of the disease of cattle originated around Achefer (58.33%) higher than from others. The prevalence was low cattle originated around Adet (15%) compared with other origins. It has statistical significance difference (X^2=12.49, p=0.029). The reason may be due to swampy and marshy area as compare from others. It is suitable for the survival of its intermediate host and the parasite itself (Bedarkar *et al.*, 2008).

The cattle worm burdens in slaughtered animals the majority of them were infected with mild to moderate worm burdens. Mild infected cattle (0-50 number of worms) higher in Percentage (45.45%) than that of

moderate (31.8%) and highly infected cattle (23.72%). This study was inline with previous study (Almaz, 2007). The reason may be due to body defense mechanism of slaughtered cattle, livestock management system and may be environmental influences cattle (Sumanth *et al.,* 2004).

The retrospective study on human schistosomiasis for three consecutive years; aimed to know the rate of the infection, particularly *S. mansoni* (45.1%, 37.0% and 9.8% in 2000, 2001 and 2002 years respectively. These finding was in lined with recent report (Lemelem, 2008). The reason may be due to wide spread of common or individual pipe drinking water source and development of urbanization (Coura and Amaral, 2004). The disease infects people of all ages; but it is higher in prevalent in young people (69.0%) than that of adult (15.3%) and old (7.5%) age groups. These finding was in lined with (Lemelem, 2008) prevalence rate was higher in Children from 10-14 years 68%, 15-19 years 64% was found. The reason may be due to children need playing, swimming in any water body, watching animals in marshy areas and catching of fishes in lakes, rivers these leads easily exposed to the diseases. But such variations usually depend on the extent of water contact and the species of parasite. Human behavior is an important factor in the transmission of schistosomiasis. Human excreta-related behavior governs the release of schistosome eggs into the environment via urine and faces, and human water-contact behavior leads to exposure the disease. The prevalence of the disease was higher in male than that of females (59.7%), (32.3%) respectively. It is in lined with that of (Gashaw, 2010), 59% in male 45% in female was reported.

CONCLUSION

The outcome of this study strongly suggests that bovine schistosomosis is one of the endemic disease in the study area that deserves serious attention. Cattle schistosomosis cause significant economic loss throughout the world. This is due to the nature of the disease. Therefore, it is important to obtain more information on natural schistosome's infection in cattle in general, and on the evaluation of the host-parasite relationship under condition of challenge in particular Season had great role for disease rate of infection. The prevalence variation of the disease was high and also had statistical significant difference in cattle among body condition infield survey as well as origin in abattoir survey. To determine the prevalence of bovine schistosomosis post mortem examination was the confirmatory diagnosis of Schistosomiasis. The rate of infection of human schistosomiasis in the study area was decreases with in three consecutive years and higher in infection rate in young as well as male human beings.

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