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A Cross Sectional Study on the Prevalence and Possible Risk Factors of Bovine Schistosomiasis in and Around Gozamen District, Northwest Ethiopia

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Abstract

A cross sectional study was conducted from April, 2017 to July 2017 in and around Gozamen district to estimate the prevalence and possible risk factors of bovine Schistosomiasis. Simple random sampling was used to select the study animals and sedimentation technique. Out of 384 faecal samples examined 101(26.3%) were found positive for bovine Schistosomiasis. The prevalence of bovine Schistosomiasis was higher in local breed cattle (29.3%) than cross breed cattle (16.1%). Similarly, the prevalence of the disease in male and female cattle was 26.2% and 26.4%, respectively. Cattle having less than 2 years, 2-5years and greater than 5 years old had (18.8%), (28.7%) and (26.0%) disease prevalence, respectively without significant statistical difference ($p>0.05$). The highest prevalence of Schistosoma infection was observed in poor body conditioned animals (35.5%) followed by medium body conditioned animals (21.1%). Whereas, the lowest prevalence of the disease was observed in good body conditioned animals (11.4%). There was also statistically significant difference among in different body conditioned animals ($p<0.05$). The prevalence of the disease was highest in extensively managed animals (30.6%) in relative to semi intensive (18.0%) and intensive management system (8.3%). 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 Gozamen distric. 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.

Keywords: Gozamen, Bovine, Prevalence, Schistosomiasis, Sedimentation.

1. 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 Intercalatum* (Dwight *et al.*, 2003).

Schistosomes are dioecious (separate sex) trematodes or flukes with flat bodies (Lefevre *et al*., 2010), which live in the vascular systems (mesenteric vein, portal vein), bladder and typically in other organs of their definitive hosts (Urquhart *et al*., 1996). The term Schistosoma means split body and refers to the fact that the males have a ventral groove called gynaecophoric canal (Urguhart *et al*., 1996) 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 Intercalatum, Schistosoma spindale, S.nasalis and Schistosoma indicum* have significant veterinary important in live stock production in Africa, Asia, and south Europe (Bont, 1995). The distribution of Schistosoma infection varies from place to place. *Schistosoma bovis* is the commonest species in Africa and Mediterranean region (Aemro, 1993) whereas; *Schistosoma spindale, Schistosoma indicum* and *Schistosoma nasalis* have been reported in Asia as the major cause of Schistosomiasis (*Bont, 1995).*

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 (Urquhart *et al*., 1996).

Ethiopia is highly endemic for Schistosomiasis, since temperature in Ethiopia appears to be the major factor that affects the distribution Schistosoma species (WHO, 2010). 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 (Okpala *et al*, 2004; Lefevre *et al*., 2010) and the disease has Public health importance (Belayneh and Tadesse, 2014). It can cause high economic losses by resulting mortality, low fertility, retard growth, poor productivity, low milk yield and increased susceptibility to other disease in livestock (Pitchford and Visser, 1998).

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% reported by Haile (1985), 12.3% by Amro (1993), 34% by Hailu (1999), 28% by Ameni *et al*. (2001),17.4% Yalelet (2004), 10.93% Almaz (2007), 22.06% Solomon (2008), 37.3% Almaz *et al.* (2011) and 24.3% by Belayneh and Tadesse (2014) in and around Bahir Dar and), 27.13% in Dembia district reported by Alemseged (2010) and also 10.17% in fogera district resulted by Mersha *et al.* (2012).

Even though these works have been done in differents parts of the country but there was no study conducted in Gozamen district on the prevalence of the disease. Therefore, the objective of this study was:

- To estimate the prevalence of bovine Schistosomiasis in and around Gozamen district and to identify the possible risk factors for the occurrence of the disease.

2. Materials and Methods

2.1 Study area

The study was conduct from April, 2017 to June, 2017 in Gozamen, which is one of the 18 districts in East Gojjam zone of Amhara National Regional State. It is found in the North western highlands of Ethiopia at a geographical location of 10°1′ 46″ and 10° 35′ 12″ N latitudes and 37° 23′ 45″ and 37° 55′ 52″ E longitudes and at a distance of 305 and 251 km from Addis Ababa and Bahir Dar, respectively. Debre Markos is the capital of the district and it contains 25 rural-kebeles. The district was surrounded by Aneded and Debay Tilatgin in the East, Machakel and Debre Elias in West, Sinan district in North, Baso Liben district and Abay River in the South.

The district has an altitudinal difference of 1200-3510 meter above sea level. Based on these altitudinal differences, the district has three agro-climatic zones namely, Dega, Woina-dega and Kola meter above sea level. The average annual rainfall of the district was 1628 mm with the rainy season extended up to 6 months. However, the heavy rainfall is concentrated in the Meher season of June to September. The maximum and minimum average temperatures are 25°C and 11°C, respectively. The most dominant soil types are Nitosols, Vertisols and Cambisols while, Pheazomes, Acrisols and Leptosols are associate soil types in different parts of the district.

Agriculture is the mainstay of farmers in the district which is characterized by mixed crop livestock production systems. The most important crops grown in the district are cereals like wheat, teff, maize, barley and oats. Pulse crops such as horse beans and chickpeas are produced. Oil seed crops (linseed and Niger seed), Vegetables (onion, garlic, potato, tomato, pepper and carrot) and fruits (banana, mango, papaya, orange and lemon) are also produced in the district. The district has a livestock population of 220190

cattle, sheep and goat 121147, 40131 equines, 133970 poultry and 10,996 beehives. (DoARD, 2009).

2.2. Study animals

The sampling units of the study were cattle of different breed, age, sex and that were found in Gozamen woreda. The study animals were sampled from different sites of the study area. The breed of cattle was categorized as local and cross (local v_s Holstein Friesian) breeds. This study included both sex of cattle and their age groups, which were categorized as <2 years, 2-5 years and >5 years old. The age of each animal was estimated using the dentition pattern (Annex: 2). The cattle had different body condition scores like, good, medium and poor body condition score (Annex: 2) and they were kept in three different management systems (extensive, semi intensive and intensive management systems).

2.3. Study design and examination method

A cross sectional study was conducted on local and cross breed cattle to estimate the prevalence of bovine Schistosomiasis and its possible risk factors in Gozamen woreda from April, 2017 to June, 2017.
This study was performed by coprological examination of samples which were collected from randomly selected animals. 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 gozamen woreda veterinary labolarotory. Then, the samples were examined by using sedimentation technique.

2.4. Sample size determination and sampling method

The sample size of the study was calculated according to Thrusfield (2005). To determine the sample size, the expected prevalence of 50% was considered by 95% confidence interval at an absolute precision of 5%. Accordingly, the required sample size was calculated to be 384.

By using the following formula,

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

Where: n= required sample size

p_{exp}= expected prevalence
d= desired absolute precision

$$n=\frac{(1.96)^2 p^{exp}(1- p^{exp})}{d^2}$$

$$n=\frac{(1.96)^2*50\%*(1-50\%)}{5\%^2}$$

$$n=\frac{3.8416*0.5*(1-0.5)}{0.0025}$$

$$n=\frac{0.9604}{0.0025}$$

n=384

Therefore, the number of cattle, examined in this study was calculated to be 384.

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 384 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 Gozamen district by using lottery system. This sample size was proportionally distributed to the three selected study areas to avoid biasnes and to asses the prevalence of the disease in each selected site.

2.5. 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 as dividing the number of positive animals by 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 the disease with various possible risk factors. In this analysis p-value less than 0.05 at 5% level of significance were considered as statistically significant.

3. Results

The prevalence of Schistosomiasis in bovine was investigated based on the presence of *Schistosoma bovis* in the faecal samples. Out of the total 384 faecal samples examined, 101 (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 statistically significant difference in prevalence between local and cross breeds of cattle, among different age groups and between sex groups of study animals.

Table 1: Overall prevalence of bovine Schistosomiasis on the study areas.

Total No. of animals examined	No. of possitive	No. of negative	Prevalence
384	101	283	26.3%

When the prevalence of Schistosoma infection was compared between animals of diffrent origin,the highest prevalence was observed in Suntera (36.7%) followed by Chertekel (28.1%) and Enerata (14.1%) and also there was statistically significant difference among the prevalence ($p<0.05$) (Table 2).

Table 2: The prevalence of Schistosoma infection in relation to study site.

Origin	Total examined animal	No.ofpositive (%)	No. of negative (%)	χ^2	*P*-value
Suntera	128	47(36.7)	81(63.3)		
Chertekel	128	36(28.1)	92(72.0)	17.277	0.000
Enerata	128	18(14.1)	110(96.0)		
Total	**384**	**101(26.3)**	**283(73.7)**		

The prevalence of bovine schistosomiasis was higher in local breed cattle (29.3%) than cross breed cattle (16.1%) (Table: 3). However, there was no statistically significant difference in prevalence of Scistosoma infection bteween the two groups of breeds of cattle ($p>0.05$) (Table 3).

Table 3: Prevalence of Schistosoma infection between local and cross breed cattle in and around Gozamen woreda

Breed	Total examined animal	No. of positive (%)	No. of negative (%)	χ^2	*P*-value
Local	297	87(29.3)	210(70.7)	6.049	0.08
Cross	87	14(16.1)	73(83.9)		
Total	**384**	**101(26.3)**	**283(73.7)**		

When the prevalence of schistosoma infection in the two sex groups of animals was compared, the prevalence in females (26.4%) was slightly higher than that of prevalence in males (26.2%). However, there was no statistically significant difference between the prevalence of both sexes ($P > 0.05$) (Table 4).

Table 4: Prevalence of Schistosoma infection between sex groups of cattle in and around Gozamen woreda.

Sex	Total examined animal	No. of positive (%)	No. of negative (%)	χ^2	*P*-value
Male	168	44(26.2)	124(73.8)	0.02	0.53
Female	216	57(26.4)	159(73.6)		
Total	**384**	**101(26.3)**	**283(73.7)**		

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).

Table 5: Prevalence of Schistosoma infection among the different age groups of cattle in the study area.

Years	Total examined animal	No. of positive (%)	No. of negative (%)	χ^2	*P*-value
<2	48	9(18.8)	39(81.3)		
2-5	174	50(28.7)	124(71.3)	1.956	0.376
>5	162	42(26.0)	120(74.1)		
Total	**384**	**101(26.3)**	**283(73.7)**		

The prevalence in poor body conditioned animals (35.5%) 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).

Table 6: Prevalence of Schistosoma infection among animals of different body condition in and around Gozamen woreda.

Body condition	Total animal examined	No. of positive (%)	No. of negative (%)	χ^2	P-value
Poor	186	66(35.5)	120(64.5)		
Medium	128	27(21.1)	101(78.9)	17.870	0.000
Good	70	8(11.4)	62(88.6)		
Total	**384**	**101(26.3)**	**283(73.7)**		

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 (30.6%) than semi intensive management system (18.0%), while the lowest was observed in animals kept under intensive management system (Table 7). However there was statistically significant difference in prevalence among animals in different management system (p<0.05).

Table 7: Prevalence of Schistosoma infection among cattle kept under different management system in and around Gozamen woreda.

Management system	Total animal examined	No. of positive (%)	No. of negative (%)	χ^2	P-value
Extensive	271	83(30.6)	188(69.4)		
Semi intensive	89	16(18.0)	73(82.0)	9.795	0.007
Intensive	24	2(8.3)	22(91.7)		
Total	**384**	**101(26.3)**	**283(73.7)**		

4. Discussion

In this study, the prevalence of Schistosoma infection was examined based on the presence of schistosoma eggs in the faecal samples. The overall prevalence of bovine Schistosomiasis in this study was 26.3%. The result of this study is almost comparable with other studies done previously in and around Bahir Dar 34% Hailu, (1999), 17.4% Yalelet, (2004), 10.93% Almaz, (2007), 22.06% Solomon, (2008), 37.3 % Almaz *et al.*, (2011), 24.3% Belayneh and Tadesse, (2014) and 27.13% in Dembia district by Alemseged, (2010) and also 10.17% in fogera district by Mersha *et al.*, (2012).

The variation in the prevalence of bovine Schistosomiasis may be due to different in sampling time, environmental factors like humidity difference, availability of stagnant water body and swampy nature of the study area, which is suitable for the development and multiplication of the intermediate host; snail and management system variations of the areas.

The prevalence of the disease was higher in local breed cattle (29.3%) as compare to cross breed cattle (16.1%) (Table: 3). This might be due to most local breed cattle were kept in outdoor and repeatedly exposed for Schistosoma infection. The different was not statistically significant ($p>0.05$). In support of this study Belayneh and Tadesse, (2014)) recorded prevalence of 24.9% in local breed and 18.5% in cross breed cattle. However, Almaz *et al,* (2011) reported higher prevalence in cross breed cattle than that of breeds in and around Bahir Dar.

There was no statistically significant difference observed in prevalence of Schistosoma infection on both sexes ($p>0.05$).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 (26.0%) and it was the least in age group of below 2 years (18.8%). However, the difference in the prevalence among the three age groups was not statistically 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 (Bushara *et al*., 1982). This result agrees with the work of Belayneh and Tadesse, (2014) 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 Mersha *et al., (*2012) 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 Suntera (36.7%) followed by Chertekel (28.1%), whereas the lowest prevalence of the disease was also observed in Enerata (14.1%). There was also statistically significant difference ($p<0.05$). This difference might be due to the variation in geographical settlement of the study areas. As described by Urguhart *et al*., (1996); 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 prevalence was highest in poor body conditioned animals (35.5%) than medium body condition (21.1%) and good body conditioned animals (11.4%) and the variation was statistically significant ($p<0.05$). This result agreed with the result of Hailu (1999) and Belayneh and Tadesse, (2014). It is the fact that, the disease defense mechanism of the animals with poor body condition is very low. And also might be traditionally, the farmer harvest green foodder from the marsh areas where the snails are found and fed their animals in order to compensate their body condition score.

The prevalence of bovine Schistosomiasis was highest in animals that were kept under extensive management system (30.6%) followed by in animals from semi-intensive management system (18.0%) and the lowest prevalence was observed in animals that were kept under intensive management system (8.3%). And also the difference was statistically significant ($P<0.05$). This result was agreed with Alemseged (2010) and Belayneh and Tadesse, (2014). It is the fact that, animals belonging to the extensive management system are more exposed to Schistosomiasis than those animals kept in door. Relatively, the prevalence of bovine Schistosomiasasis was lower in intensive management system than semi intensive management system. The reason may be related to; in case of intensive management system animals were managed indoor. So the risk of exposure for the disease is low.

However, they may be exposed for the disease in the condition of contamination of feeding and watering troughs as well as in supplementation of green foodders which is harvested from marsh areas containing cercarial stage of the parasite.

5. Conclusions and Recommendations

The prevalence of bovine schistosomiasis recorded in this study based on coprological examination revealed that bovine schistosomiasis is one of the endemic diseases in the study area that deserve serious attention in the future. The disease can cause significant economic loses throughout the world. The disease was detected in breeds of cattle, sexes, age groups, body condition score, management systems and in randomly selected origins of the study animals. In addition, occurrence of the disease is closely linked to the presence of bio-types suitable for the development and multiplication of intermediate hosts. Therefore, this study revealed that bovine schistosomiasis was one of the major parasitic diseases contributing to loss in productivity and production of cattle in the study area. 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 Gozamen woreda.
- 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.
- Awareness should be created for the owners of the animals about the risk factors of the disease and its transmission, as much as possible do not allow to graze their cattle freely on swampy or marsh areas and also supply dry feeds and clean water for their cattle regularly .
- Strategic treatment and deworming interventions should be applied to prevent losses incurred by Schistosomosis and also further detailed studies are needed to gather enough information about the parasite itself and its intermediate host, which is used to control Schistosoma infection in the area.
- Researches should be encouraged towards the development of vaccines for Schistosoma infection which is considered as control measurement of the disease.

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