Original Research Article

Prevalence of Bovine Schistosomiasis and its Associated Risk Factors in and around Gondar, Ethiopia

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Abstract

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A cross sectional study was conducted from December to April, 2023 in and around Dembia district to determine the prevalence of Bovine Schistosomiasis and associated risk factors. A total of 247 cattle were enrolled in this study. A fresh fecal sample was collected directly from the rectum and examined using sedimentation technique. The data collected was coded and entered Excel sheet spread and exported in to SPSS version 20 for analysis. Descriptive statistic in the form of table and percentage and analytical statistics like chi-square were employed to determine associated risk factors. The current study revealed that the overall prevalence of Bovine Schistomiasis was 25.9% (64/247) in the study area. The prevalence of bovine Schistosomiasis was higher in local breed cattle (93.1%) than cross breed cattle (6.9%). Similarly, the prevalence of the disease in male and female cattle was 51% and 49%, respectively. Based on the age variation, Cattle having more than five year 53%, between 2-5 23.1% and less than two year 23.9%). The highest prevalence of *Schistosoma* infection was observed in medium body conditioned animals (55.9%) followed by good body condition (25.5%) and lower in poor body conditioned animals (18.6%) The prevalence of *Schistosoma* infection in relation with body condition score was not statically significant (p>0.05), The prevalence of the disease was highest in extensively managed animals (79.4%) in relative to semi intensive (20.6%), there was no statistically significant difference among the three management systems (p>0.05). A highest prevalence (43.7%) of Bovine Schistosomiasis was recorded in Adisgie (43.7%) followed by robit (42.5%) and Woynatana(13.8) kebele. therefore, this study indicated that bovine Schistosomiasis is becoming one of the major cattle health problems in and around Dembia. 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: Bovine schistosomiasis, Cattle, Dembia, Prevalence, Risk fa

INTRODUCTION

Ethiopia has a large livestock population, with an estimated 60.39 million cattle, 31.3 million sheep, 32.74 million goats, 11.32 million equines, and 1.42 million camels (Mengistu *et al.*, 2021). The sector contributed up to 40% of agricultural Gross Domestic Product (GDP), nearly 20% of total GDP, and 20% of national foreign exchange earnings in 2017 (Mengistu *et al.*, 2021). Livestock is a major source of animal protein, power for

crop cultivation, means of transportation, export com-modities, manure for farmland and household energy, security in times of crop failure, and means of wealth accumulation. Despite the importance of these animals, their productivity is low due to a number of factors such as inefficient management, poor infrastructure, poor marketing and credit facilities, feed shortages both in quality and quantity, and health constraints. Among health constraints parasitism is found to be a serious threat to the livestock economy worldwide (Molla *et al.,* 2022). Trematodes in general and schistosoma in particular have been reported as one of the major problems both in animals and humans around the world (Jejaw *et al.,* 2015).

Bovine Schistosomiasis is a snail-borne trematode infectious disease in man, domestic animals and wild animals that cause the economic loses through reduction of the production and productivity potential of animals in tropical and sub-tropical country (Levere *et al.,* 2010; Islam *et al.,* 2011; Jejaw *et al,* 2015). The taxonomic classification of the organism that causes schistosomiasis will be presented as Platyhelminthes, class Trematoda, sub class digenea, super family schistomatidea, Genus schistosoma and species schistosoma bovis, *S.matheei, S.mansoni, S.hematobium, S.nasalis,* and *S. spinalis* (Thrusfied, 2005; Utzinger *et al.,* 2015). The schisto-somes or schistosoma means split body and refers to the fact that the male have a ventral groove called gynaecophoric canal (Marquardt and Grieves, 2000). Schistosomes are thin, elongated fluke, up to 2 cm long primarily parasitize in the blood vessels of alimentary tract and bladder responsible to cause schistosomiasis. The predilection sites for this parasite are the mesenteric, portal vein and typically in other organs of the final hosts (Urquhart *et al.,* 2000).

In Ethiopia, various epidemiological study conducted on bovine schistosomiasis are indicative of the epidemicity of the disease particularly in large stagnant water bodies and marshy free grazing areas (Getachew *et al.,* 2014). The prevalence of *S. Bovis* has been reported various parts of Ethiopia (Belayneh and Tadesse, 2014; Mihret and Samuel, 2015; Tsega, and Feyissa, 2017; Kerie and Seyoum, 2016; Kassahun *et al.,* 2017; Molla *et al.,* 2022). Although diverse research outcomes have been published from various areas of the country, but, there is no enough information regarding the persistent water bodies in the present study area. Despite the fact that the study area, Lake Tana, is rich in wetland fields that favour the growth and development of Schistosomes species biological vectors (snails), as Defersha and Belete, (2018) reported the prevalence of schistosomiasis was 17.6% at West Dembia and a 13.1% prevalence at East Dembia district and indicated as it was the major constraints for livestock productivity in the area and considering persistent water bodies of the current study areas this study was needed to have updated scientific information on the disease's current prevalence and epidemiological data on associated risk factors. As a result, the current study was designed to assess the prevalence of Bovine Schistosomiasis and its associated risk factors in Dembia district which is situated in the North Gulf of Lake Tana, found in Amhara National Regional State.

Therefore, the specific objectives of this study were:-

➢ To determine the prevalence of Bovine Schisto-somiasis
➢ To identify risk factors associated with the disease

MATERIALS AND METHODS

Study Area

The study was conducted from December 2022 to april 2023 in Dembia district which is situated in the North Gulf of Lake Tana, found in Amhara National Regional State. The study area is at the nearest distance, about 30 km, from Gondar town and a distance about 768 km away from the capital city of the country, Addis Ababa. Geographically it is located at $12.3º$ to $13.38º$ north latitudes and $35.5º$ to $38.3º$ east longitudes. And the altitude of the district ranges from 1800 to 2000 m.a.s.l. The district on average receives an annual rainfall is 1600 mm. The average yearly minimum and maximum temperature is 18 °C and 28 °C respectively (CSA, 2013). Based The livestock population in the Dembia district was accounted as the number of cattle populations in the district is about 314,423 among the three selected kebele was accounted as the number of cattle populations in the kebele about Weynatana,4355 Adisge,3643 and Robit,1599 (DDAO, 2015). Figure 1

Study Population

The population of this study was cattle from three kebele of Dembia district. Both breeds (local and cross), the management systems of animals, origins of animals, age, body condition, and sex groups (male and female) were considered as risk factors in the this study. Age of animals was categorized in to three i.e. less than and equal to 2 years, above two and below 5 years and above 5 years old. The age of each animal was estimated using the dentition pattern of the animals as described in (Pope, 2008). The body condition of animals was categorized into three body condition scores: poor, medium and good body condition scores (Pope, 2008)

Study Design

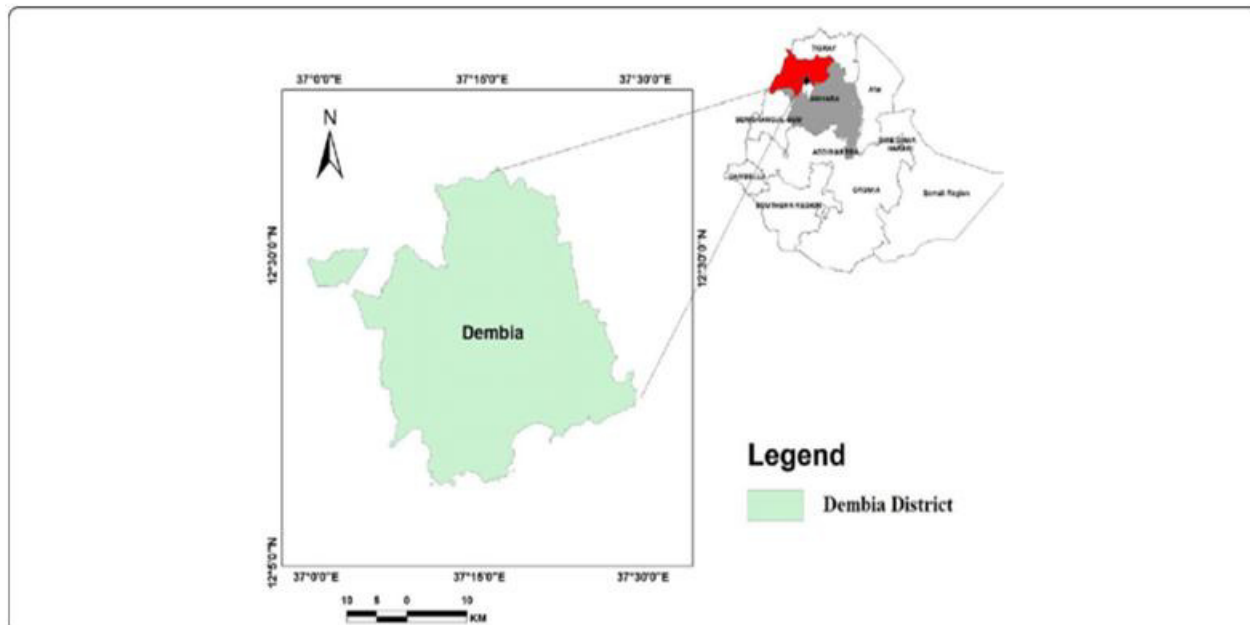A cross-sectional design was conducted from December, 2022 to April, 2023 to estimate the current prevalence

Figure 1. Location of the study district the map shows Dembia district of the Amhara region, Northwestern Ethiopia. It is located at12.3º to 13.38ºN and 35.5º to 38.3º E Source (CSA, 2013)

and to identify associated risk factors of Bovine schistoso miasis in east Dembia district.

Sample Size Determination and Sampling Methods

A cattle considered in the study was selected using simple random sampling technique. The sample size was determined by using the formula recommended by Trusfeld (2005). In the study, with 95% confidence level, 5% desired absolute precision and 20.1% prevalence, as reported by (Defersha and Belete 2018). were considered. The sample size calculated using single proportion formula was 247.

$$\frac{(1.96)2 \, X \, Pexp \, (1 - pexp}{d^2}$$

Where:
n= required sample size
Pexp= expected prevalence
d^2 = desired absolute precision

Sample Collection and Laboratory Procedure

After proper restraining and recording all relevant information like date of sample collection, identification numbers of animals; age, sex, body condition, breed, management and origin of animal; fresh fecal samples was collected directly from the rectum of individual animals using glove and preserved by 10% formalin. Then it was subjected to chorological examinations using sedimentation technique at University of Gondar

Veterinary Parasitology Laboratory as indicated by (Chanie et al., 2012).

Data management and analysis

Data obtained from field and laboratory analysis was entered in to Microsoft Excel Spreadsheet. After Checking and clearing of data, it was exported to SPSS version 20 for analysis. Descriptive statistics in the form of table and percentage were used to describe the result. Chi-square (X^2) was used to determine the associated risk factors and P-value less than 0.05 was considered as significant.

RESULTS

Prevalence and Demographic characteristic

Among the total of 247 collected feacal sample examined indicated that 64/247 (25.9%) were positive for Bovine *Schistosomiasis*. The demographic characteristics of the study revealed that prevalence for each site was 42.5%, 13.8%, 43.7% in Robit, Weynatana, Adisgie, respectively (Table 1) and the prevalence of *Schistosoma* in relation with the origin of animal in which sample collected was insignificant (p>0.05). It was observed that more than half of the studied animals were male (51.0%), but both female and male were equally exposed to infection (25.4%) and sex-wise distribution of *Schistosoma* infection was insignificant (p>0.05). The higher percent-

Table 1. Demographic characteristics (n=247)

Variables		Frequency	Percentage	X^2	P-value
	Male	126	51.0		
Sex	Female	121	49.1	0.035	0.851
	Total	247	100.0		
	Less than 2 Years	59	23.9		
Age	2-5 Years	57	23.1	2.127	0.345
	More than 5 Years	131	53.0		
	Total	247	100.0		
	Local	230	93.1		
Breed	Cross	17	6.9	2.216	0.137
	Total	247	100.0		
	Good	63	25.5		
	Medium	138	55.9		
Body condition	Poor	46	18.6	5.388	0.068
	Total	247	100.0		
	Extensive	196	79.4		
Management Type	Semi intensive	51	20.6	1.330	0.249
	Total	247	100.0		
	Robit	105	42.5		
Origin	Weynatana	34	13.8	4.525	0.104
	Adisgie	108	43.7		
	Total	247	100.0		

age of the animals were found in the age group >5 years (53.0%) and age-wise distribution of *Schistosoma* infection was insignificantly varied (p>0.05) in different age groups. However, the prevalence of bovine schistosomiasis in different age groups was found to be 5.7%, 7.7% and 12.6% in less than 2 years, 2-5 years and more than 5 years respectively. Most of studied animals were (93.1%) local breed with prevalence of bovine schistosomiasis revealed that there was higher prevalence rate (23.1%) in local breed than cross (2.8%). But, there was statistically insignificant difference on the prevalence of bovine schistosomiasis based on breed (p>0.05) as shown in (Table 1). In the present study, it was indicated that higher percentage of cattle with medium body condition (55.9%) was enrolled followed by good body condition (25.5%) and poor body condition (18.6%) score. The prevalence of *Schistosoma* infection in relation with body condition score was not statically significant (p>0.05), cattle with medium body condition score (13.4%) were more infected with *Schistosoma* than cattle with poor (7.3%) and (5.3%) good body condition score. Majority (79 .4%) of the studied animals were managed under extensive type farm management. The prevalence of Bovine schistosomiasis was higher in extensive (21.9%) than (4.0%) in semi-intensive management system, but, there was statistically insignificant difference on the prevalence of bovine schistosomiasis based on management system (p>0.05) as shown in the Table 1 above.

DISCUSSION

The cross-sectional study was conducted to determine the prevalence of Bovine Schistosomiasis and associated risk factors related to its occurrence. Accordingly, the overall prevalence of Bovine Schistosomiasis in the study area was found to be 25.9% (64/247). The current findings was consistent with the previous studies conducted by (Kerie and Seyoum, 2016), who reported a 24.6% prevalence in South Achefer district, by (Tadesse and Belayneh, 2014), who reported a 24.3% prevalence in Bahir Dar town, by (Miressa and Feyissa,2017), who reported a 22.9% prevalence in Bako Town of Oromia, and by (Kasahun *et al.*,2017), who reported a 23.9% prevalence in the North western Ethiopia, by ;Samuel et al., (2016) who reported a 24.3% and (26.3%) prevalence in Bahir Dar town and its surrounding areas, respectively. The result of the current study was slightly lower than the study reported by (Habtamu and Solomon (2011), in selected sites of Bahir Dar who reported the overall prevalence 37.3% respectively. This difference might be due to the fact that the studies conducted in the previous collected large number of samples from where cattle could permanently or seasonally come in contact with water lodged area and conducted repeated faecal examinations which might be increase the prevalence of disease, whereas the present study covers lower sample and collected feacal samples only once around water lodged area. Furthermore, as (Defersha and Belete,

2018) reported the prevalence of schistosomiasis was 17.6% at West Dembia district and 13.1% prevalence at East Dembia district. The difference might be due to reasons such as the activities of the animal owners that lead to exposure like managements, lack of awareness about the disease in the districts, shortage of veterinary services to prevent and control the parasite.

The results obtained both by coprological and postmortem examination are higher when compared with previous findings of (Mihret and Samuel, 2015), who reported (7.6%) in and around Debre Tabor town, Adane and Mulat, who reported (11.5%) in Dangila district, (Molla, et al., 2022) who reported (16.7%) prevalence in the selected districts of South Wollo and Oromia Zones of Amhara Region, North-East Ethiopia. The probable reasons for the higher prevalence in the present study might be due to the presence of known water bodies (lakes) in the selected sites may favor the development and multiplication of intermediate hosts and study design, methodology, epidemiology, farm husbandry and agro-ecological variation in studied areas.

It was observed that more than half of the studied animals were male (51.0%), but both female and male were equally exposed to infection (25.4%) and sex-wise distribution of Schistosoma infection was insignificant (p>0.05). The current study disagreed with the studies conducted by Asmare and Samuel (2015); Temesgen et al., (2022), and found a higher prevalence in females (33.1%) than males (27.1%) and in females (16.9%) than males (8.2%) respectively. The higher percentage of the animals were found in the age group >5 years (53.0%) and age-wise distribution of Schistosoma infection was insignificantly varied (p>0.05) in different age groups. However, the prevalence of bovine schistosomiasis in different age groups was found to be 5.7%, 7.7% and 12.6% in less than 2 years, 2-5 years and more than 5 years respectively. The difference might be due to unequal exposure of animals to the infection due to the young cattle kept in house and have less exposure of the disease. Most of studied animals were (93.1%) local breed with prevalence of bovine schistosomiasis revealed that there was higher prevalence rate (23.1%) in local breed than cross (2.8%). But, there was statistically insignificant difference on the prevalence of bovine schistosomiasis based on breed (p>0.05) as shown in (Table 1). This finding was found to be in line with the previous prevalence studies of (Defersha and Belete, 2018) who reported (21.2%) in local breed than (7.7%) in cross breed animals, (Tadesse and Belayneh, 2014), with prevalence reports of 24.9% in local and 18.5% in cross breed in Bahir Dar Town; and (Alemayehu and Asrat, 2015) with prevalence reports of 12.0% in local and 8.5% in cross breeds in Dangila district. The current finding disagreed with the findings of (Mihiret and Samuel 2015) reported a prevalence of 7.2% in local and 8.3% in cross breeds in and around Debre Tabor Town: (Solomon, 2008) reported higher prevalence in cross breeds

(25.83%) than local breeds (16.66%). The difference between breed might be due to the management techniques that a local breed cattle managed extensively and have greater exposure to the parasite and a crossbred cows were kept for milk purposes and semi-intensively managed in study area. In the present study, it was indicated that higher percentage of cattle with medium body condition (55.9%) was enrolled followed by good body condition (25.5%) and poor body condition (18.6%) score. The prevalence of Schistosoma infection in relation with body condition score was not statically significant (p>0.05), cattle with medium body condition score (13.4%) were more infected with Schistosoma than cattle with poor (7.3%) and (5.3%) good body condition score. this finding was Disagreed with result of Temesgen et al., 2015) reported the prevalence (37.1%) of poor condition compared with cattle with moderate body condition (13.8%), (Shiferaw and Deressa 2017) reported a prevalence of 32.46% in poorly conditioned cattle and 21.42% in cattle compared to medium body conditions, (Kifle et al., 2022) reported.

that the prevalence of schistosomiasis was 23.81% in poorly conditioned cattle and 3.92% in medium body conditioned cattle. Different studies found that animals with poor body condition scores were more affected than other groups of animals, and the difference here might be due to the difference in exposure to the schistosome parasite. Majority (79 .4%) of the studied animals were managed under extensive type farm management. The prevalence of Bovine schistosomiasis was higher in extensive (21.9%) than (4.0%) in semi-intensive management system, but, there was statistically insignificant difference on the prevalence of bovine schistosomiasis based on management system (p>0.05) as shown in the Table 1 below. With regarding to the origin/kebele, the prevalence of Bovine Schistosomiasis showed insignificant difference among studied kebele. A highest prevalence (43.7%) of Bovine Schistosomiasis was recorded in Adisgie (43.7%) followed by robit (42.5%) and Woynatana (13.8) kebele might be due to the presence of highly swampy area surrounding this kebele and communal grazing land and water source forms a favorable environment for the multiplication intermediate host snails of snail that increasing the chance of Schistosoma infection to occur.

CONCLUSION AND RECOMMENDATION

According to the present study, the overall prevalence of bovine Schistosomiasis was found to be 25.9% in and around dembia. The study also revealed that the prevalence of Schistosomiasis is high in Sebatamit and followed by kebele adige, robit and Woynatana. The study also revealed that sex, body condition, age, breed, origin and management system were not (statistically non-significant). The prevalence of the disease is also

closely linked with environmental factors that are suitable for the development and multiplication of snail which is intermediate hosts and the parasite. Schistosomiasis should be taken in to consideration as one of the major limiting factor of livestock production and can cause significant economic losses. In general bovine Schistosoma infection was endemic in the study area. Based on the above conclusion the following recomm-endation are forwarded

✓ Regular deworming before and after rainy season.
✓ Repeatedly examine   up to 5-6 slide in one fecal sample because bovine Schistosomiasis very difficult to find in lower microscope for the future researchers.

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ANNEXES

Annex 1: Sample collection format

Adm zone-------------woreda----------------sample collection site (kebele) ---------------date---------------- altitude---------------

NO	Owner name	spp	age	Sex	Breed	Bcs	Type of sample	Result
1								
2								
3								
4								
5								
6								
7								

Annexes 1:   Method of sample collection and procedures of sedimentation techniques'

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 from afield survey and clinic . 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 regional laboratory. Then, the samples were examined by using sedimentation techniques

Procedure of sedimentation techniques

Principle;   this   method   is   qualitative   method   for   detecting   egg   concentrated   in   the   feces most Trematode   are relatively larger and heavy compared nematode egg.
Collect the feces from field survey and clinic
Take 3g of faces in conical cup and mix thoroughly with 40-50 ml of tape water
Sieve the mixture through a tea strainer in to   a test tube
Allow to sediment for 5 minute
Decant the supernatant very carefully
Stain the sediment by adding one drop of 1% methylene blue
Take a drop and examine under a microscope

Annex 3. Declaration sheet

DECLARATION

I, the under signed, declare that the information presented here in my thesis is my original work, has not been presented for degree in any other university and that all sources of materials used for the thesis have been duly acknowledged

Name: _____

Signature: _____

Date of submission: _____
This   thesis   has   been   submitted   for   examination   with   my   approval   as   university   advisor   Name _____

Signature: _____