Journal of Veterinary Medicine and Health

Research Article Open Access

The Neglected Infectious Disease, Bovine Schistosomiasis: Prevalence and Associated Risk Factors for its Occurrence among Cattle in the North Gulf of Lake Tana, Northwest Ethiopia

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Abstract

Schistosomiasis is a snail-borne trematode infection in man, domestic animals and wild animals in tropical and sub-tropical countries and it is one of the neglected tropical infectious diseases yet having considerable impacts from the public health and economical dimensions. A cross sectional study was conducted from October, 2017 to April, 2018 in the North Gulf of Lake Tana, Northwest Ethiopia to estimate the prevalence of Bovine Schistosomiasis and to explore the different associated risk factors that influence its occurrence. Simple random sampling technique was employed to select 304 study cattle from three selected districts. Of the 304 cattle considered, 20.1% (61/304) were found to be positive for *Schistosoma bovis* on coprological examination. The prevalence of Bovine Schistosomiasis was highest in Takusa district (29.1%) followed by West Dembia (17.6%) and East Dembia districts (13.1%) respectively. The difference in prevalence of Bovine Schistosomiasis among three districts was statistically significant (x^2=8.612, P =0.013). With a statistically significant difference (x^2=10.920, P=0.004) in prevalence among the differently body conditioned animals, the highest prevalence of Bovine Schistosomiasis was recorded in the poor body conditioned animals (29.3%) followed by animals having medium (14.0%) and good (13.3%) body condition scores respectively. Age of animals was found to be an important risk factor for the occurrence of Bovine Schistosomiasis and the highest prevalence was recorded in age group of cattle between 2-5 years (30.2%) than in animals above 5 years of age (15.7%) and that of age group below 2 years (6.7%) and the variation in prevalence of Bovine Schistosomiasis among the age groups was statistically highly significant (x^2=16.426, P=0.000). With no statistical significant difference in prevalence of Bovine Schistosomiasis, higher prevalence was indicated in local (21.2%), females (20.7%), and extensively managed animals (21.2%) than the prevalence in the cross breeds (7.7%), males (19.3%) and semi-intensively managed animals (15.6%) respectively. This much prevalence of Bovine Schistosomiasis in the study area necessitates that prevention and control measures targeting the parasite, snail intermediate host and husbandry systems be designed to reduce the productivity, economic and public health impacts that the disease, Bovine Schistosomiasis, may pose.

Keywords: Bovine schistosomiasis; Cattle; Lake tana; *Schistosoma bovis*

Introduction

Livestock production constitutes one of the principal means of achieving improved living standards in many regions of the developing world [1]. In both developed and developing countries, livestock plays vital roles in generation of income, creating job opportunities, ensuring food security, providing draught power and serving as raw materials for industries. Livestock contributes as an asset, socio-cultural and environmental values, and sustain livelihoods [1,2].

Ethiopia is known for its vast wealth of livestock in Africa [3]. There are an estimated 70.79 million heads of cattle, 28.48 million sheep, 25.91 million goats, 24.56 million donkeys, 11.39 million horses, 8.08 million mules, 8.39 million camels, 50.38 million poultry and 71.62 million beehives [4]. Ethiopian Human population is mostly dependent on agriculture, which contributes 46.3% of the country's Gross Domestic Product (GDP), 60% of exports, and 80% of total employment [5]. However, the economic benefit derived from the livestock sector does not commensurate with the potential due to a number of complex and inter-related factors [3].

Parasitism is a major challenge to livestock development and trematode parasitism is one of the major problems for both animal and human productivity around the globe [6]. Trematode parasites are found in immense water lodged and swampy grazing fields [7]. Bovine Schistosomiasis is a snail-borne trematode infectious disease in man, domestic animals and wild animals in tropical and sub-tropical countries [8]. It is an economically important disease caused by several Schistosoma species, which inhabit the vascular system of final hosts [9]. It is one of the 15 neglected diseases in the tropics and endemic in sub-Saharan Africa, the Middle East, Far East, Central America and the Caribbean [10]. In the tropics and sub-tropical countries, where the disease is endemic, it poses significant effects on livestock production [11]. Bovine Schistosomiasis affects sheep, goat and cattle [12] and causes mortality and morbidity from severe infection and long term effects of moderate and long standing chronic infections [13]. The distribution of Bovine Schistosomiasis has been determined principally by the distribution of snail intermediate host [14]. In the chronic stages of the Bovine Schistosomiasis, the pathology is associated with collagen deposition and fibrosis, resulting in organ damage and dysfunction [2]. Coprological analysis is commonly employed to diagnose Bovine Schistosomiasis [15]. Infections with all major Schistosoma species can

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Received September 03, 2018; **Accepted** November 06, 2018; **Published** November 16, 2018

Citation: Defersha T, Belete BA (2018) The Neglected Infectious Disease, Bovine Schistosomiasis: Prevalence and Associated Risk Factors for its Occurrence among Cattle in the North Gulf of Lake Tana, Northwest Ethiopia. J Vet Med Health 2: 112.

be treated with praziquantel [16]. The goal of treatment is reduction of egg production via reduction of worm load: this reduces mortality and morbidity [17].

In Ethiopia, epidemiological studies suggest the endemicity of the disease particularly in the areas with large permanent water bodies and marsh pasture areas [18]. The prevalence of *S. bovis* has been reported by different studies conducted in different localities of Ethiopia. To mention, a few of the reports are: a 1.2% prevalence in Gewane and a 5.5% prevalence in Awassa by Lemma [19] in Bahir Dar town a prevalence of 33.8% by Hailu [20], 22.06% prevalence by Solomon [21] and prevalence of 24.3% by Belayneh and Tadesse [22] and in Kemisse a 28% prevalence by Ameni et al. [23] and a 13.7% prevalence in Fogera by Mersha et al. [24] in and around Debre Tabor Town, a 7.6% prevalence by Mihret and Samuel, [15] a prevalence of 27.13% in Dembia district by Alemseged et al. [25] in and around Bakko Town, a prevalence of 22.92% by Miressa, and Feyissa, [14] in South Achefer district, a 26.9% prevalence by Kerie and Seyoum, [13] in Dangila District, a prevalence of 11.5% by Adane and Mulat, [26] and in North Western Ethiopia, a prevalence of 23.9% by Kassahun et al. [10].

Though the study area, North gulf of Lake Tana, is rich with wetland fields that favor the breeding and development of Schistosoma species biological vectors (snails), there is a light of scientific information that has been done on the current prevalence and status of the disease in the study area and epidemiological data with regard to associated risk factors of the Bovine Schistosomiasis in the North Gulf of Lake Tana. Therefore, this study was gird with the objectives of:

1. To estimate the prevalence of Bovine Schistosomiasis among cattle in selected districts along the North Gulf of Lake Tana, and
2. To identify the different associated risk factors that associated with the occurrence of Bovine Schistosomiasis among cattle in the North Gulf of Lake Tana.

Materials and Methods

Study area

The study was conducted in the North Gulf of Lake Tana with emphasis given to Dembia (East and West) and Takusa Districts, found in Amhara National Regional State. The study area is at the nearest distance, about 30 km, from Gondar town that is found at a distance about 738 km away from the capital city of the country, Addis Ababa. Geographically located at 12.3° to 13.38° north latitudes and 35.5° to 38.3° east longitudes and the altitude ranges from 550 to 4620 m above sea level in western lowland and in north Semen Mountain, respectively. The average annual rain fall vary from 880 mm to 1772 mm. The mean annual minimum and maximum temperature is 10°C in the highland and 44.5°C in the lowland [27]. The livestock population in the Dembia district is accounted as 314,423 cattle, 58,601 sheep, 18,659 goats, 147,720 poultry, 20,205 donkeys, 269 mules, 58 horses and 12,485 bee colonies [28] whereas the livestock population in the Takusa District is composed of 255,217 cattle, 17,067 sheep, 51,509 goats, 30465 donkeys, 718 mules and 28 horses, as well as 129,056 human population [29].

Study population

The population of this study was cattle from different areas of the three districts. 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 study parameters in the field survey. 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 [30]. The body condition of animals considered was categorized into three body condition scores: poor, medium and good body condition scores [31].

Study design

The study design was cross-sectional.

Sample size and sampling methods

Cattle considered in the study were selected using simple random sampling technique. The sample size was determined by using the formula recommended by Thrusfield [32]. In the study, with 95% confidence level, 5% desired absolute precision and 27.13% prevalence, as reported by Alemseged et al. [12], 304 cattle were considered. To calculate the sample size single proportion formula was used.

$n = (1.96)^2 \times P_{exp} (1-P_{exp}) / d^2$

Where:

n= required sample size

P_{exp} = 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; fresh fecal samples were collected directly from the rectum of individual animals using gloved hands. Ten percent formalin was used as preservative. Each sample was labeled with age, sex, body condition, breed, management and origin of animal. Collected samples were subjected to coprological examinations using sedimentation technique at University of Gondar Veterinary Parasitology Laboratory. For the trematode egg identification, one drop of methylene blue was added. Sedimentation technique was employed to assess the presence of Schistosoma eggs through repeated dilution of the fecal suspension and sedimentation of the eggs and then observed under low power (10x) microscope in the laboratory as indicated by [33].

Data management and analysis

Data obtained from field and laboratory analysis were entered in to Microsoft Excel Spreadsheet. Checking and clearing data and variable, data were then exported to SPSS version 20 computer Soft Ware Program for analysis. Descriptive statistics were used to summarize. Prevalence of Schistosoma infection were expressed as a percentage, calculated by dividing number of positive animals by total number of animals tested. Chi-square (x^2) test was also used to determine whether risk factors have associated with disease prevalence or not.

Results

Among a total of 304 bovine species examined, 61/304 (20.1%) were found to be positive for *Schistosoma bovis* (Tables 1 and 2).

No of Animals	Frequency	Percent
Positive	61	20.1
Negative	243	79.9
Total	304	100.0

Table 1: The overall prevalence of the disease, Bovine Schistosomiasis, among cattle in the North Gulf of Lake Tana, Northwest Ethiopia.

Risk factors	Category	No of animal examined	No of animal positive	Prevalence in (%)	X^2- Value	P- Value
Age	0 < x <2	60	4	6.7	16.426	0.000
	2<x < 5	129	39	30.2		
	x > 5	115	18	15.7		
Sex	Male	140	27	19.3	0.098	0.754
	Female	164	34	20.7		
Breed	Cross	26	2	7.7	2.714	0.099
	Local	278	59	21.2		
Body condition	Good	60	8	13.3	10.920	0.004
	Medium	121	17	14.0		
	Poor	123	36	29.3		
Management	Semi intensive	64	10	15.6	0.997	0.318
	Extensive	240	51	21.2		
Origin	East Dembia	99	13	13.1	8.612	0.013
	West Dembia	102	18	17.6		
	Takusa	103	30	29.1		

X = age of animals.

Table 2: Prevalence and level of significance of associated risk factors for *Schistosoma bovis* among cattle in the North Gulf of Lake Tana, Northwest Ethiopia.

Varying prevalence of Bovine Schistosomiasis among the districts were found, which indicated a 29.1% prevalence at Takusa district, a 17.6% prevalence at West Dembia district and a 13.1% prevalence at East Dembia district. In this study the prevalence of Bovine Schistosomiasis between the two sex categories was found to be 20.7% and 19.3% in female and male cattle. Regarding the influence of the age of animals on the occurrence of Bovine Schistosomiasis, the prevalence of Bovine Schistosomiasis in age groups between two and five years were higher (30.2%) than that of age groups greater than five years (15.7%). And less prevalence of Bovine Schistosomiasis was recorded in age groups less than two years.

Discussion

The overall prevalence of Bovine Schistosomiasis was found to be 20.1% (61/304). The overall prevalence is almost similar with the other previous studies conducted by Kerie and Seyoum [13], who reported a 24.6% prevalence in South Achefer district, by Tadesse and Belayneh [22], who reported a 24.3% prevalence in Bahir Dar town, by Samrawit [11], who reported a 24.3% prevalence in Bahir Dar town and its surrounding areas, by Miressa and Feyissa [14], who reported a 22.9% prevalence in Bako Town of Oromia, and by Kasahun et al. [10], who reported a 23.9% prevalence in the North western Ethiopia. In this study, lower prevalence of Bovine Schistosomiasis was found when the overall prevalence is compared with previous reports of Hailu [20] in Bahir Dar area, Almaz and Solomon [34] in selected sites of Bahir Dar Alemseged et al. [25] who reported overall prevalence of Bovine Schistosomiasis to be 29%, 37.3%, and 27.13% respectively. The difference in the overall prevalence of Bovine Schistosomiasis between the findings of the current study and the studies conducted previously may be attributed to the encouragement of livestock owners to improve their husbandry practices following semi-intensive (tied and feed with concentrate and roughage feed) management systems that reduce the exposure of the animals to the marshy area grazing lands and watering from the surrounding lake Tana. It would be due to the activity of veterinarians in the study area towards the health care of animals. It may also be due to the fact that Trematode is 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 excreted in the faces, half of the eggs remain in the blood circulation and most of these eggs get trapped in the liver and spleen or in the bladder and ureter [35]. The number of adult parasites established in the mesenteric veins and the stage of infection may also determine fecal egg output.

The overall prevalence of this study was found to be relatively higher than the overall prevalence reports of Yalelet [36] in and around Bahir Dar, Lo and Lemma [37] in Hawassa, Abebe et al. [38] in Agaro, Alemayehu and Asrat [12] in Dangila district, Mersha et al. [24] in Fogera cattle, and Mihiret and Samuel [15] in Debre Tabor, who reported overall prevalence of 17.4%, 5.5%, 4.59%, 11.5%, 13.7% and 7.6% respectively. The difference in the overall prevalence of Bovine Schistosomiasis between the report of the current study and previous reports might be due to variations in drainage system for irrigation practice (favors the development and multiplication of snail intermediate hosts), environmental factors such as agro-ecology and climate, sampling periods, epidemiological factors such as hosts breed, availability of stagnant water body, river, marshy area and animal management/husbandry practices of animals like freely grazing on the pasture land and/or the watering system of the animals.

With regards to the different districts considered in the study, a highest prevalence (29.1%) of Bovine Schistosomiasis was recorded in Tsakusa district. This highest prevalence record in Tsakusa district might be due to the presence of the river known as Givaza that passes between GirarMeda and Sensay communal grazing land that may create conducive environments for the intermediate host and is the major water source to animals originated from the capital city of Tsakusa district, Delgi and the surrounding rural kebeles. The highest prevalence may also attributed to the presence of Girar Meda Toka, Sensay Toka, Chegera Toka and Chach Ena Alwa village Toka marshy and swampy pasture lands at the gulf of lake Tana from which animals graze in common. In support of this theory, Getachew et al. [18] has explained that bovine Schistosomiasis is an endemic disease particularly in areas with large permanent water bodies and marsh pasture areas.

The prevalence of Bovine Schistosomiasis in west Dembia district, Gorgora city and the surrounding rural kebeles was the second highly prevalence record (17.6%). This result might be due to the presence of highly swampy communal range land near to Lake Tana called, Kidame Gebaya, and most of the animal owners in the area were found to water their animals in the Lake Tana. The least prevalence (13.1%) of Bovine Schistosomiasis was recorded in east Dembia district. This difference may be due to having seasonal marshy areas which are found at some

distance far from lake Tana and the presence of dry lands which are the communal grazing lands of most animals managed extensively in the area. Not only this, this may also be attributed to the presence of small rivers which serve as the watering system of animals rather than Lake Tana.

Among the age categories considered in this study, the highest prevalence of Bovine Schistosomiasis was recorded in animals with age groups between two and five years (30.2%) followed by animals with age groups of greater than five years (15.7%) and less than two years (6.7%). The difference in the prevalence among the three age groups was statistically highly significant (P=0.000). This result was in agreement with previous findings of Miressa and Feyissa [14], who reported 24.6% in young (2 to 5 years) and 19.2% prevalence in adult (above 5 years) in Bako Town of Oromia, Samrawit [11], who reported a 29.16% prevalence found in animals with ages between age group of two and five years, 21.47% prevalence in animals with ages above five years and a 19.35% prevalence report in animals with age groups bellow two years old in Bahir Dar and its surrounding areas [15], reported an 11.5% prevalence in animals with age group between two and five years, 8.5% in animals with age groups of above five years, and 3.15% prevalence in animals with ages bellow two years in Debre Tabor [25], who reported a 17.60% prevalence in animals bellow 2 years of age, a 30.10% prevalence in animals having ages between 2 and 5 years, and 27.80% prevalence in animals that were categorized as above 5 years old in Dembia distinct [22], who found a 29.2% prevalence in animals aging between two and five years, a 21.5% prevalence in animals with age category above five years and a 19.4% prevalence in animals aging bellow two years in Bahir Dar Town.

The prevalence of Bovine Schistosomiasis [between two and five years (30.2%), greater than five years (15.7%), less than two years (6.7%)] among the different age categories revealed in this study was found to disagree with the reports of Addis et al. [39], who reported a 25.6% prevalence in adult (above five year), and a 21.6% prevalence in young (below five year) in the North West Ethiopia [26], who reported a 14.7% prevalence in less than two years old, and 11.7% prevalence in animals between two and five years, and a 10.2% prevalence in animals above five years old in Dangila district, Awii Zone [40] who reported that the prevalence of the disease is dependent on age and cattle less than two years old has the highest prevalence rate since they have less immunity developed to resist the new infection than others.

The presence of significant difference among age categories might be because of unequal exposure of animals to the infection due to the management related risk factors. The management system in the study area was mostly a free grazing, extensive husbandry type. Animals in the range of two to five years have the capacity to travel long distance for grazing and watering purpose than other age categories, thereby the probability they may acquire infection is high in these animals. In support of this, studies reported that infection rate is increased with the increase of age and peak infection will occur at the maturity age [41]. This might be due to a long exposure time because adult animals move long distances in search of scarce pastures and water thereby increasing their chances of infection as well as becoming infected at overcrowded watering holes. On the other hand, the very young calf do not graze extensively as the older do, so they get less infection of cercariae unlike adult animals [42,43] also reported that the increased contact time with Schistosoma infested habitat increases the rate and endemicity of schistosomiasis. The lower result in adult (above five years) as compared to young (2-5 years old) could be due to strong acquired immunity against the parasites, which could suppress the worm fecundity and decrease the release of parasitic eggs within the faeces. In older animals, fecal egg counts remain low, tissue egg counts seem to follow the pattern of the faecal egg counts, while worm burden tends to increase with the age of the host [44] as cited by [45]. Evidence also suggests that with increasing duration of exposure to continuous challenge, cattle become less susceptible to re infection. Examination of naturally infected animals has shown that partial protection against re infection also occurs, and acquired resistance to schistosomiasis is of major importance in the regulation of infection intensity in the field [46].

In this study, sex of animals was considered as a risk factor and the result indicated a statistically insignificant (P=0.754) prevalence of 19.3% and 20.7% in male and female cattle respectively. This finding was found to be in agreement with reports of previous works of Kassahun et al. [10] who reported a prevalence of 24.3% in female and 23.5% in male, in north western Ethiopia: Miressa and Feyissa [14] who reported a 28.09% prevalence in female and 18.45% prevalence in male in and around Bako Town; Kerie and Seyoum [13] with a report of 33.1% prevalence in female and 27.1% prevalence in male in the selected sites of South Achefer distict: by which in all of the findings of previous studies the diference in prevalence of Bovine Schistosomiasis between sexes were not statistically significant (P>0.05). However the present finding was not in agreement with the previous findings of Assefa et al. [47] who reported 28.7% prevalence in male and 25.1% in female in and around Bahir Dar: Mersha et al. [24] who reported 15.38% prevalence in males and 12.14% in females. The differences in prevalence with significant values might be due to the difference in grazing behavior, animal management (both sex groups in the study area are allowed to graze the same pasture land extensively and watering is also the same for both sexes): both sexes might or might not be at the same risk to acquire the infection.

The current study has found a statistically insignificant (P=0.099) higher prevalence of Bovine Schistosomiasis in local breed (21.2%) than the cross breed animals (7.7%). This finding was found to be in line with the previous prevalence studies of Tadesse and Belayneh [22], with prevalence reports of 24.9% in local and 18.5% in cross breed in Bahir Dar Town; Samrawit [11] in Bahir Dar and its surrounding areas with the same prevalence of Tadesse and Belayneh [22] and Alemayehu and Asrat [12] with prevalence reports of 12.0% in local and 8.5% in cross breeds in Dangila district. In a disagreement to the current finding, Mihiret and Samuel [15] reported a prevalence of 7.2% in local and 8.3% in cross breeds in and around Debre Tabor Town: Solomon [21] reported higher prevalence in cross breeds (25.83%) than local breeds (16.66%). The higher prevalence of the local breed animals than cross breed recorded in this study might be due to the more exposure of the local animals to the marshy areas and thereby the higher exposure to the cercaria because most of the animals of the local breeds are left for extensive grazing system while cross breeds are kept for the purpose of milking in semi-intensive or otherwise intensive management systems and in most of the times they are fed concentrate and other roughages with supplements and they drink clean water. Alemseged et al. [25] also reported that local breeds are more affected by Bovine Schistosomiasis than cross breeds. And the difference in prevalence was not due to the difference in susceptibility but due to the difference in exposure. Cross breeds are mostly kept for dairy or fattening purposes and they are mostly housed and fed with good feed and they obtain clean water which reduces their access to the cercariae; while the local ones are mostly managed extensively to graze freely and they get access to infective stages of the parasite.

The present finding also disclosed highest prevalence (29.3%) in poor body conditioned animals followed by medium (14.0%) and good (13.3%) body conditioned animals. The difference in the prevalence

of Bovine Schistosomiasis among the differently body conditioned animals was found to be statistically significant (P=0.004). The finding was in agreement with the prevalence reports of: Miressa and Feyissa [14], who reported a prevalence of 32.46% in poor body conditioned animals, 21.42% in medium body conditioned animals and 11.86% in good body conditioned animals in and around Bako Town: Belayneh and Tadesse [22], who reported a prevalence of 68.88% in poor body conditioned animals, 17.57% in medium body conditioned animals and 11.36% in good body conditioned animals, in Bahir Dar Town: Mihiret and Samuel [15] who reported a prevalence of 11.9% in poor body conditioned animals, 6.9% in medium body conditioned animals and 3.4% in good body conditioned animals in and around Debre Tabor Town: Alemayehu and Asrat [12], who reported a prevalence 23.1%, 9.7% and 5.1% in animals having poor, medium, and good body condition scores respectively in Dangila district; Kerie and Seyoum [13], who reported a prevalence of 66.7%, 15.8% and 8.8% in animals scorining poor, medium, and good body conditions respectively, in south Achefer district.

The prevailing study finding about the influence of body condition of the animals on the occurrence Bovine Schistosomiasis was in a disagreement with the reports of Kassahun et al. [10] who reported the highest prevalence of Bovine Schistosomiasis in animals with a medium body condition score (25.7%) followed by in animals with poor (24.3%) and good (21.7%) body condition scores, in North western Ethiopia Samrawit [11] who reported a prevalence of 10.3% in poor, 12.3% medium and 1.7% in good body conditioned animals in Bahir Dar and its surrounding areas. The variation in prevalence among body conditions of animals in the different studies might be due to the variation of acquired immunity status of poor animals. Weak animals become more suppressed and susceptible, which might be due to malnutrition and other parasitic infections which inhibit the activity of animal's immune system. Moreover, *S. bovis* infection can result in weight loss or poor body condition score and weak acquired immunity [48].

Regarding to the influence of animal management system on the prevalence of Bovine Schistosomiasis, a higher prevalence, but with no statistically significant difference (P=0.318), was found in animals under extensive management system (21.2%) than that of the animals in the semi-intensive management system (15.6%). The result was in agreement with the reports of Samrawit [11] who reported a 25.18% prevalence in animals under extensive and a 15.38% prevalence in animals under semi-intensive management systems in Bahir Dar town and surrounding areas; and Tadesse and Belayneh [22] with the same prevalence to Samrawit [11] in Bahir Dar. The variation in prevalence might be due to the reason that animals under the extensive management system (animals which kept outdoor) are more exposed to the intermediate host while grazing in pasture land and watering in the river or lake than those animals kept indoor (semi-intensively managed animals).

Conclusion

Bovine Schistosomiasis was found to be considerably prevalent among cattle in all the three districts along the North Gulf of Lake Tana. The different associated risk factors (especially of age, body condition, and animal origin/in the districts) considered to have influence on the occurrence of Bovine Schistosomiasis were found to importantly influence the prevalence of the disease. Among the three districts considered in the study, highest prevalence of Bovine Schistosomiasis was found in Takussa district, followed by West and East Dembia districts that might be attributed to the existence of highest number of swampy and marshy areas in Takussa district and the high number of animals accessing Lake Tana for watering purposes. The statistically significant differences in prevalence of Bovine Schistosomiasis among age groups of animals considered and among the differently body conditioned animals can be used to explain that these risk factors are important in the occurrence of Bovine Schistosomiasis. The outcome of the study strongly suggests that Bovine Schistosomiasis is prevalent in the study area and demands for measures to be taken to prevent the economic and public health problems that the disease may pose. Based on the finding, the following recommendations are forwarded:

1. Bovine Schistosomiasis should be taken into consideration as one of the major constraints for livestock productivity in the three districts.
2. Awareness, to livestock owners, about the disease transmission and risk factors associated with the occurrence of Bovine Schistosomiasis should be considered important; so that owners can avoid grazing of their animals in highly marshy and swampy areas, and they can take care of infection of themselves.
3. Further research should be conducted with emphasis given to parasitic and intermediate host biology and ecology with the identification of the different Schistosoma species and snail species prevailing in the districts; so that prevention and control interventions can be applied at the environment, animal host and mankind levels.

Acknowledgment

The authors would like to forward the in-depth acknowledgement to the University of Gondar, College of Veterinary Medicine and Animal Sciences. The authors also would like to extend their sincere thanks to Elias Melkamu, the Technical Assistant at Parasitology Laboratory at the college for him providing the required help during the study period. Last but not least, the entire cattle owners who generously contributed to this study by providing necessary information and their time are highly acknowledged.

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