Prevalence of Bovine flukes in Irrigation Canals of Amibara District, Afar Region, North-East Ethiopia

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Abstract: A cross-sectional study was carried out from November to April, 2016 in irrigation canals of Amibara District of Afar Region, Ethiopia with the aim of determining the prevalence of major bovine flukes. Simple random sampling was used to select both the study animals and Peasant Associations. Coprological examination using sedimentation technique was applied for the recovery of the flukes' eggs from freshly collected fecal samples. The collected data were entered and analyzed by using SPSS 21 version software. Out of the total 400 fecal samples examined, 183 (45.8%) were infected with bovine flukes infection. The prevalence of Paramphistoma, Fasciola and *Schistosoma bovis* was 15.3%, 9.5% and 7.3%, respectively in the study area. The result indicated that the prevalence of the flukes was higher in females (46.3%) than males (42.4%). It was also slightly higher in young (< 2 years) cattle (46.4%) than adult ones (>2 years) (43.9%). Among the associated risk factors, the highest prevalence of infection with flukes was observed poor body condition animals (63.4%) and statistical significant difference was observed with the occurrence of flukes infection ($p<0.05$). There were mixed infection: Fasciolosis and Paraphistomosis, 31 (7.75%); Paraphistomosis and Schistosomiasis, 7 (1.75%); Fasciolosis and Schistosomiasis, 11 (2.75%) and Fasciolosis, Paraphistomosis and Schistosomiasis, 6 (1.50%) in study area. This study indicated that bovine flukes are the major cattle parasites in the study area. Thus, awareness creation should be done for the livestock owners about intermediate host (snail) and strategic deworming in order to reduce pasture contamination. Moreover; further study on snail dynamics and infection rates should be conducted so as to design effective prevention and control strategies.

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Introduction

Ethiopia has huge number of cattle population in Africa [1]. The cattle population was estimated at about 56.9 million heads which helps to improve the livelihoods of the community especially pastoral communities in the country [2]. It serves as productive, financial, social asset, means of investment, important source of cash income and ensuring food security [3]. However, cattle production and productivity is still very low in relation to a huge numbers due to widespread of animal diseases, inadequate and poor quality of animal feed; limited veterinary services; poor selection and breeding and lack of proper technology package. Among the bottle neck challenges of cattle production, trematodes parasites are the main once [4, 5].

Flukes of ruminants are flat worm (trematodes) parasites living in liver (*Fasciola*), proventriculus (*Paraphistomum*) or blood (*Schistosoma*). The occurrence of the parasites is depending on the suitable ecological conditions for the growth and multiplication of intermediate host (snails) [4]. These parasites cause a significant economic loss which includes death, loss in carcass weight, reduction in milk yield, condemnation of affected liver, decline production and productive performances, exposure of animals to other diseases due to secondary complications and cost of treatment expenses [6, 7, 8, 9]. Moreover; the public significance of Fasciolosis and *Schistosomosis*have been reported from different parts of the world including Ethiopia. Human acquire infection through ingestion of metacercariae that are attached to certain aquatic plant and vegetable [10, 11, 12]. Nevertheless, there was no well documented information about the prevalence of major bovine flukesin the irrigation canals of Amibara district, Afar Region, northeast Ethiopia. Therefore, the study was designed to determine the prevalence of bovine flukesand asses associated risk factors in study area.

Materials And Methods

Study Area

A cross sectional study was conducted from November to April, 2016 in Amibara district of Afar Regional State of Ethiopia. The district is found at 344 km of northeast of Addis Ababa. It is one of the three

administrative zone which is bordered on the south, west, north, east, southeast by Awash Fentale, Awash River, Gewane and Somali Region and Oromia Region, respectively. The towns which is found in the district Awash Arba, Awash Sheleko, Melka Sedi and Melka Were. It is located 10°9′59N latitude and 40°8′43E longitude and the altitude of the area is 560 meters above the sea level. The climate of the area is normally hot and dry. The mean annual temperature of the area reaches 29.5°C. The rainfall is between July and September and a short rain is during March and April with 663.7 mm total annual rainfall [13].

The total human population of district is 63,378, of whom 35,374 are men and 28,004 women; with an area of 2,007.05 square kilometers, it has a population density of 31.58. While 28,137 or 44.40% are urban inhabitants, a further 6,555 or 10.34% are pastoralists. A total of 13,729 households were counted in this district, which results in an average of 4.6 persons to a household, and 14,773 housing units [14].

The majority of the populations in the area lead a pastoral way of life searching for better grazing and watering sites for their livestock. Cattle are a source of income generation and meat needed for religious ceremonies burial, visitors, famine and women giving birth. Irrigation has contributed significantly to poverty alleviation, food security, and improving the quality of life for rural populations. However, water and food-borne diseases are commonly associated with the introduction of irrigation such as *Paraphistomosis, Fasciolosis* and *Schistosomiasis.* During the rainy season the animals are grazing freely on the open range whereas, in dry season, the cattle are moved to swampy and low laying areas near the irrigation canals.

Study Animals

The study animals were indigenous Afar breeds of cattle reared under small holders and found in three peasant associations of the study district namely Hasoba, Halaydegi and Bonta that vary in sex, age, body conditions and peasant association from pastoral farming system in the study area.

Sampling and Sample Size Determination

Simple random sampling technique was used to select the study animal and peasant associations (PAs). The number samples was allocated proportionally for selected PAs until the sample size attained. The sample size was calculated using the standard formula described by [15]. Since there was no previous work done in this area, the expected prevalence is to be 50%. So, the sample size was determined using the following formula.

$$n=\frac{1.96^2\,(p)\,(1-p)}{d^2}=384$$

Where; n = Sample size, p = Expected prevalence (50%), 1.96 = the value of Z at 95% confidence level and d^2 = Desired absolute precision = 5%. To increase the precision, the sample size was calculated to be 400.

Data Collection Method

Fecal samples were collected directly from the rectum of animals using disposable plastic gloves. The samples was placed in a universal bottle containing 10% formalin after labeling and stored at 4°Crefrigerator until the specimen processed and examined for parasite eggs. Coprological examination using sedimentation technique was used to detect the presence or absence of fluke eggs in the fecal sample collected, as described [16]. During sampling, relevant information about individual animal was recorded. The ages of animals were also estimated as < 2 years (young) and > 2 years (adult) based on dentition method [17]. The body condition of the animal grouping into three categories as poor, medium and good [18].

Coprological Examination

Approximately 10 grams fecal samples were collected directly from the rectum of the animal. The fecal sample was then put into 10% formalin filled universal sampling bottle. After labeling with specific identification number, each sample was transported to Aklilu Lemma Institute of Pathobiology, Addis Ababa University for coprological examination. Sedimentation technique was employed to assess the presence of trematode eggs through repeated dilution of the fecal suspension and sedimentation of the eggs, which are heavier than most of the fecal particles. Three (3) grams of feces was crushed using pestle and mortar then 42ml of water had been added and let to sediment. The supernatant was discarded and the sediment part had been put on the slid and observed under a microscope of 10x magnification power and the egg of the flukes. Methylene blue was used to differentiate the egg of Fasciola from that of Paraphistoma egg. Identify their eggs according to shape, size, color and operculum cell [4].

Data Analysis

The collected data were entered and analyzed by using SPSS version 21. Descriptive statistics called person Chi-Square (2) test was used to determine the association between heamonchosis infestation rate and study variables. A statistically significant association between variables exists when $p<0.05$ at 95% confidence level.

Results

Overall Prevalence of Bovine flukes

Out of 400 fecal samples collected and examined, 183 (45.8%) were infected with bovine flukes. About 61 (15.3%), 38 (9.5%) and 29 (7.3%) were found be positive for Paramphistoma, Fasciola and *Schistosoma bovis*, respectively. Mixed types of

parasites infection were also harbored: Paramphistoma + Fasciola, 31 (7.8%); Paraphistome + *Schistosoma bovis,* 7 (1.8%); Fasciola + *Schistosome bovis*, 11 (2.8%) and Paraphistome + Fasciola +*Schistosome bovis*, 6 (1.5%). The highest relative percentage was recorded for Paraphistomum 105 (26.3%), followed by Fasciola 86 (21.5%) and *Schistosoma bovis* 53 (13.3%) in single infection. Among the mixed infection, Paraphistome+ Fasciola had the highest prevalence, 31 (7.75%) whereas, the lowest was by Paraphistome + Fasciola +*Schistosome bovis*, 6 (1.50%) ($p<0.05$) (Table 1).

Table 1. Overall Prevalence of Bovine flukes (single and mixed infections) in the study Amibara District, Afar Region, Ethiopia

Bovine flukes	**No of +Ve**	**Prevalence (%)**	**2(p-value)**
Paraphistome (p)	61	15.3	**4.00 (0.00)**
Fasciola (f)	38	9.50	
Schistosoma bovis (S)	29	7.25	
P+F	31	7.75	
P+S	7	1.75	
F+S	11	2.75	
P+F+S	6	1.50	
	183	**45.8**	

In this study, the overall prevalence of bovine flukes was slightly higher in female (46.3%) than male animals (42.4%). The prevalence of flukes was also slightly higher in young age (46.4%) than adult age (43.4%). There was no statistical significant difference observed among sex, age and the flukes infection ($p>0.05$). With respect to body condition score, the highest prevalence of infection with flukes was observed poor body condition score (BCS) animals (63.4%). There was statistical significant difference observed between body condition score and flukes infection ($p<0.05$) (Table 2).

Table 2. Prevalence of Bovine flukes infection with respect to age, sex and body condition score in the study Amibara District, Afar Region, Ethiopia

Risk factors	**No of Examined**	**No of +Ve**	**Prevalence (%)**	**2 (p-value)**
Young	293	136	46.4	0.196 (0.658)
Adult	107	47	43.9	
Female	341	158	46.3	0.318 (0.573)
Male	59	25	42.4	
Poor	41	26	63.4	**10.140 (0.005)**
Medium	266	125	47.0	
Good	93	32	34.4	

Prevalence of Bovine flukes infection with respect to Peasant Associations

The study indicated that the overall prevalence of Bovine flukes was higher in Hasoba peasant association (51.3%) followed by Halaydegi (43.2%) and Bonta (37.5%) Peasant Associations. There was no statistical significant difference observed amongst sites and flukes infection ($p>0.05$) (Table 3, Figure 1).

Table 3. Prevalence of Bovine flukes infection with respect to Peasant Associations, Amibara District of Afar Region, Ethiopia

Peasant Associations	**No of Examined**	**No of +Ve**	**Prevalence (%)**	**2, 9p-value)**
Hasoba	156	80	51.3	**3.582 (0.167)**
Halaydegi	204	88	43.1	
Bonta	40	15	37.5	
Total	**400**	**183**		

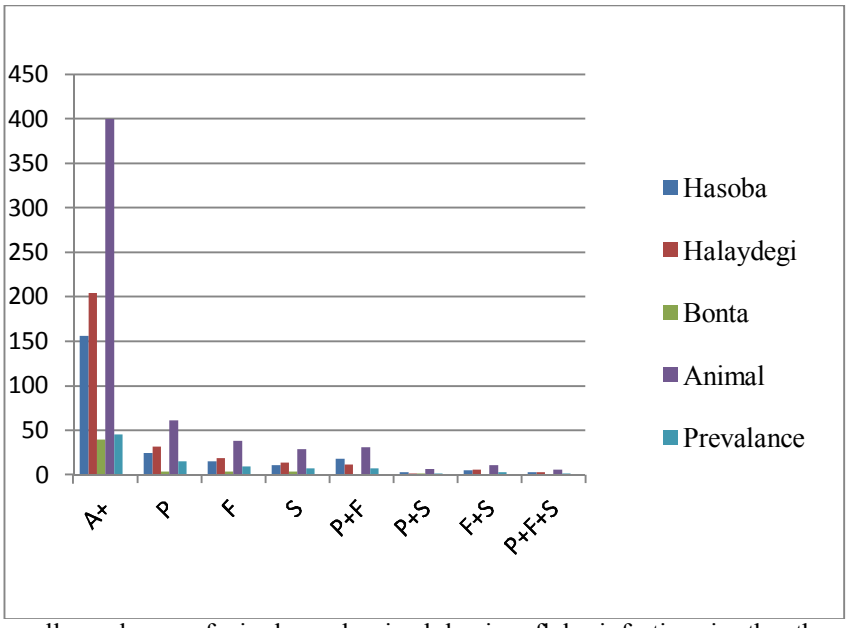

Figure 1. The overallprevalence of single and mixed bovine flukesinfection in the three selected Peasant Associations of the study area.

Remark. P=Paramphistoma, F=Fasciola, S= Schistosoma, A=Animal, P+F= Paraphistomum + Fasciola, P+S= Paraphistomum +Schistosoma, and P+F+S= Paraphistomum + Fasciola+ Schistosoma.

Discussion

The overall prevalence of Bovine flukes was found to be higher (45.8%) in the irrigation canals of Amibara district. The result of this study was lower than that of the study conducted [5] who reported 60.4% at Andassa Livestock Research Center in north-west of Ethiopia. This might be due to the difference in ecology, climate, sample size and management system [4]. The highest prevalence was recorded from Paramphistomosis (15.3%) followed by Fasciolosis (9.5%) and *Schistosomosis bovis* (7.3%). The result was lower than of the studies conducted in different areas [19] who reported, 40.1% in Debre Zeit areas; [8] who recorded 38.9% in Egypt; [20] who recorded 30% in Kenya; and [21] who recorded 22% in Pakistan. However, it was higher than the results studies conducted [22] who recorded 8.95 % in Turkey [23] who recorded 12% in cattle in Algeria. The differences among the prevalence of flukes' infection might be attributed due to the biology of the parasite and egg detection techniques of flukes. The higher prevalence of Paramphistoma infection may account partly by no effective treatment non-pathogenic helminth, and numerous intermediate hosts. Moreover, adult Paramphistoma is very prolific and many eggs are expelled [24].

In this study, the overall prevalence of Fasciolosis (9.5%) was lower than the previous studies conductedin different parts of Ethiopia which includes [25] who reported 41.4% in and around Woreta, Northwestern Ethiopia; [26] who recorded 45.3% in Assela, Southeastern Ethiopia [8] who reported 24.2% at Andassa Livestock Research Center in north-west of Ethiopia [27] who reported 88.6% in western Shewa, Western Ethiopia. This variation might be attributed to the difference in the infestation, level of study area and the present study was conducted during the dry period of the year when the infections rate of fasciolosis is expected to be low.

Similarly, the overall prevalence of *Schistosoma bovis* infection (7.3%) was lower than the previous studies in different part of the country [28] who reported 13.7% at Fogera, South Gondar Zone, Amhara National Regional State, Ethiopia; [29] who reported 24.3%in and around Bahir Dar town, Northwest Ethiopia. The result of this study was also lower than the finding of the study conducted in Bahir Dar area, 29.0% [30] and 24.7% [31]. This might be due to the variations in ecological and climatic conditions in the study areas.

The overall prevalence of bovine flukes infection was higher in young age, female and poor body conditioned animals in study area. Among the associated risk factors, body condition score was statistically significant ($p<0.05$) with the occurrence of flukes. This was in parallel with other finding [32]. The lower infection rate in adult animals is probably associated with acquired immunity, which leads to resistance to re-infection as it has been reported [33]. Health status and physiological factors of pregnancy and immune suppression of the female animal could expose to parasites [34].

The result of the study depicted that highest prevalence was found in Hasoba site (51.3%) which provides favorable ecological conditions for growth of intermediate hosts' snails and development of fluke larval stages [35]. There was no statistical significant variation between study site and the occurrence of flukes ($p>0.05$). This difference might be due to the variations in ecological and climatic conditions [27].

Conclusion

This study indicated that major bovine flukes were prevalent in study district. Both single and mixed flukes infections were isolated in the area from cattle. Highest prevalence of the flukes infection was observed on poor animals and statistical significant difference was observed between body condition score and flukes infection. The overall prevalence of flukes infections was also higher in Hasoba peasant association than other sites. Thus, awareness creation of the community about the prevention, control and transmission methods of flukes in study area. Moreover; further studies should be conducted on snail dynamics and infection rates in irrigated areas in order to design effective prevention and control strategies.

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Authors' Contributions

Tesfaye Kassa has designed the study and created survey instruments. Tsegaye Bertualem has collected the data whereas; Tadesse Birhanu has participated in data analysis, interpretation and manuscript writing. All authors read and approved the final manuscript.

Conflict Of Interests

The authors declare that there is no conflict of interests regarding the publication of this article.

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