Prevalence of bovine fasciolosis and identify the risk factors in and around Bahir Dar, Ethiopia

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Abstract

Bovine fasciolosis is a parasitic disease of cattle caused by ingesting metacercariae of liver flukes from the genus *Fasciola*. A cross-sectional study was conducted from November 2021 to April 2022, encompassing a total of 384 cattle randomly selected from diverse locations. The study included cattle of various ages and sexes, aiming to assess the prevalence of bovine fasciolosis and identify risk factors in and around Bahir Dar, Ethiopia. Fecal examinations were performed to detect fluke eggs, and data were analyzed using descriptive statistics in STATA Version 20.0 to summarize the prevalence of bovine fasciolosis. Chi-square tests assessed relationships between infection rates and risk factors, with significance set at $P < 0.05$. The overall prevalence of fasciolosis was found to be 49.21%. Analysis by origin revealed that Sebatamit had the highest prevalence at 61.84%, followed by Kebele 11 at 59.37%, Tikurit at 50%, and Latammba at 27.65%. Statistical analysis showed significant differences in prevalence among the locations. In terms of body condition, cattle in poor condition had the highest prevalence (64%), followed by those in medium condition (50%) and fat cattle (26.96%). This variation was statistically significant. Age group analysis showed similar prevalence rates, with young cattle at 50.38%, adults at 47.33%, and older cattle at 50.47%, with no significant differences observed. Sex-related differences in prevalence were also not significant, with males showing a prevalence of 49.73% and females 48.73%. Regarding breed, local cattle exhibited a slightly higher prevalence (51.62%) compared to crossbreeds (46.15%), but this difference was not statistically significant ($P > 0.05$). In conclusion, the study highlights significant variations in the prevalence of bovine fasciolosis

based on location and body condition, while no significant differences were observed among age, sex, and breed groups. These findings emphasize the importance of location-specific interventions and proper management of cattle health to control the spread of fasciolosis.

Keywords : *Bahir Dar; Bovine fasciolosis;Fecal examination; Prevalence; Risk factors*

1. Introduction

Ethiopia is home to one of Africa's largest livestock populations, comprising approximately 55.03 million cattle, 27.32 million sheep, and 28.16 million goats as of 2019. Cattle, in particular, play a vital role in the country's agricultural economy, contributing around 81.2% of the annual milk production. However, despite the significant livestock population, productivity is hindered by various challenges, including diseases, malnutrition, and suboptimal management practices. Among these, parasitic infections are a major concern, with fasciolosis being one of the most prominent parasitic diseases affecting livestock in the country [1].

Fasciolosis is caused by the ingestion of metacercariae from liver flukes of the genus *Fasciola*, typically acquired from contaminated forage, water, or raw vegetables [2-4]. The disease affects a wide range of animals, including cattle, buffaloes, sheep, and goats, and can even be transmitted to humans through the consumption of contaminated food or water [5, 6]. The flukes migrate through the liver and other organs, causing significant liver pathology, including inflammation of the bile ducts and obstruction of the biliary system [4, 7]. The disease is widespread globally, particularly in areas with suitable aquatic snail species, such as *Lymnaea truncatula* and *Lymnaea natalensis*, which act as intermediate hosts [11].

Fasciolosis poses considerable economic challenges, leading to livestock mortality, morbidity, reduced growth rates, liver condemnation, increased susceptibility to secondary infections, and the costs associated with control and treatment measures. Furthermore, it results in decreased productivity, such as reduced fertility and milk production, all of which have a significant impact on the agricultural economy of Ethiopia [12].

Previous studies have shown that various factors, including age, sex, breed, and management practices, significantly influence the prevalence of fasciolosis in livestock [9, 13, 14]. However, much of the research has focused on specific regions, and there is a need for further investigation to understand the local epidemiology of the disease in Ethiopia. Given the widespread presence of livestock in the country and the potential for large-scale economic losses, it is crucial to determine the prevalence of bovine fasciolosis and identify the associated risk factors in different regions of the country. The objective of this study is, therefore, to assess the prevalence of bovine fasciolosis and identify the risk factors in and around Bahir Dar, Ethiopia.

2. Materials and Methods

2.1. Study Area

A cross-sectional study was conducted from November 2021 to April 2022 in and around Bahir Dar, Ethiopia (Figure 1). Bahir Dar is situated approximately 575 km northwest of Addis Ababa, with an altitude ranging from 1500 to 2600 meters above sea level. The city's coordinates are 12° 29' N latitude and 37° 29' E longitude. It experiences an average annual rainfall of 1200 to 1600 mm and temperatures ranging from 8 to 31°C annually. The region is characterized by plain plateaus covering about 70% of the land, featuring various bush formations, low woods, evergreen lands, and semi-humid highland vegetation. The area is predominantly used for agriculture, cultivating crops such as teff, wheat, maize, and pulse crops [1].

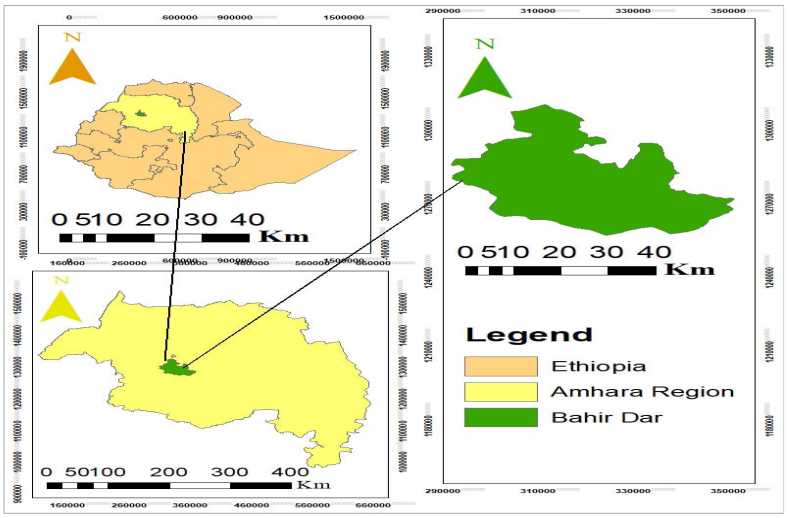

Figure 1 : Map of the the study area

2.2. Study Animal and Sampling Method

The study animals comprised cattle from selected sites in and around Bahir Dar, specifically Kebele 11, Sebatamit, Tikurit, and Latammba Kebeles. These cattle included both local breeds and crossbred Holstein Friesian cattle. A total of 384 cattle, spanning all age groups and both sexes, were randomly selected from various origins. The average age of the cattle was determined using dentition (categorized as young and adult) as described by Cringoli et al. [18], and their body condition scores were recorded following the guidelines outlined by Nicholson and Butterworth [19].

2.3. Study Design and Sample Size

A cross-sectional study design was employed to assess the prevalence of bovine fasciolosis and identify risk factors in and around Bahir Dar from November 2021 to April 2022. Factors including origin (location), breed, age, sex, and body condition were considered as potential risk factors for the occurrence of fasciolosis. The sample size for collecting fecal samples from the bovine population was determined following the guidelines outlined by Thrusfield [20], using a 95% confidence interval and 5% absolute precision, with an assumed expected prevalence of 50%.

$$n = \frac{1.96^2 \times Pexp \times (1 - Pexp)}{d^2}$$

Where n represents the required sample size, Pexp denotes the expected prevalence, and d stands for the desired absolute precision.The estimated sample size will be 384 animals.

2.4. Fecal Examination and Identification of Fasciola Eggs

Fecal samples collected directly from animals' rectums were preserved in universal bottles with 10% formalin for transport to the Bahir Dar Regional Veterinary Laboratory for analysis. At the laboratory, the sedimentation technique, following protocols detailed by Faria et al. [21] and Elelu et al. [22], was employed to detect fluke eggs present in the samples. To differentiate between *Fasciola* species eggs and other types, such as Paramphistomum species eggs, a methylene blue solution was utilized on the sediment. *Fasciola* eggs displayed a distinct yellowish hue, characterized by their larger size and thin,

operculated shells, as outlined by Hussein et al. [23]. In contrast, Paramphistomum eggs stained blue, as outlined by Mifsut and Ballarin [24].

2.5. Data Analysis

The raw data collected from the study were first organized and entered into a Microsoft Excel database using spreadsheet software. Following this, the data underwent analysis using descriptive statistics in STATA Version 20.0 to summarize the prevalence of bovine fasciolosis. To assess the statistical relationships between infection rates and various risk factors (age, sex, breed, and locality), a chi-square (χ^2) test was employed. This test compared infection rates across these factors, with statistical significance set at $P < 0.05$.

3. Results

3.1. Prevalence

In this study, a total of 384 cattle were examined to determine the prevalence of bovine fasciolosis. The overall prevalence in the study area was found to be 49.21%. Analysis based on origin showed that the highest prevalence was recorded in Sebatamit (61.84%), followed by Kebele 11 (59.37%), Tikurit (50%), and Latammba (27.65%). Statistical analysis revealed a significant variation in prevalence among these locations ($P < 0.05$) (Table 1). Regarding body condition, cattle in poor condition exhibited the highest prevalence (64%), followed by those in medium condition (50%) and fat cattle (26.96%). This difference was statistically significant ($P < 0.05$) (Table 2). When considering age groups, the prevalence was 50.38% in young cattle, 47.33% in adults, and 50.47% in older cattle. However, no significant variation was observed among these groups ($P > 0.05$) (Table 3). Similarly, there was no significant difference in prevalence between males (49.73%) and females (48.73%) ($P > 0.05$) (Table 4). With respect to breed, local cattle had a slightly higher prevalence (51.62%) compared to crossbreeds (46.15%), but this difference was not statistically significant ($P > 0.05$) (Table 5).

Table 1: Prevalence of Bovine Fasciolosis Based on Origin

Origin	**Examined**	**Positive (%)**	**χ2**	**P-value**
Tikurit	118	59 (50%)		
Sebatamit	76	47 (61.84%)	26.31	0.000
Latammba	94	26 (27.65%)		
Kebele 11	96	57 (59.37%)		
Total	384	189 (49.21%)		

Table 2: Prevalence of Bovine Fasciolosis Based on Body Condition

Body Condition	Examined	Positive (%)	χ2	P-value
Poor	125	80 (64%)		
Medium	170	85 (50%)	28.6	0.000
Fat	89	24 (26.96%)		
Total	384	189 (49.21%)		

Table 3: Prevalence of Bovine Fasciolosis Based on Age Group

Age Group	Examined	Positive (%)	χ2	P-value
Young	129	65 (50.38%)		
Adult	150	71 (47.33%)	0.839	0.3503
Old	105	53 (50.47%)		
Total	384	189 (49.21%)		

Table 4: Prevalence of Bovine Fasciolosis Based on Sex

Sex	Examined	Positive (%)	χ2	P-value
Male	187	93 (49.73%)	0.844	0.3503
Female	197	96 (48.73%)		
Total	384	189 (49.21%)		

Table 5: Prevalence of Bovine Fasciolosis Based on Breed

Breed	Examined	Positive (%)	χ2	P-value
Local	215	111 (51.62%)	0.287	1.134
Cross	169	78 (46.15%)		
Total	384	189 (49.21%)		

3.2. Identification of Fasciola Eggs

The egg of the *Fasciola* species detected in the cattle fecal sample in the study is presented in Figure 2. The criteria for identification were established using morphological features guided by Hussein et al.[23] and Mifsut and Ballarin [24]. These eggs are notably ovoid in shape with a distinctive thick, yellowish-brown shell, often displaying an operculum at one end.

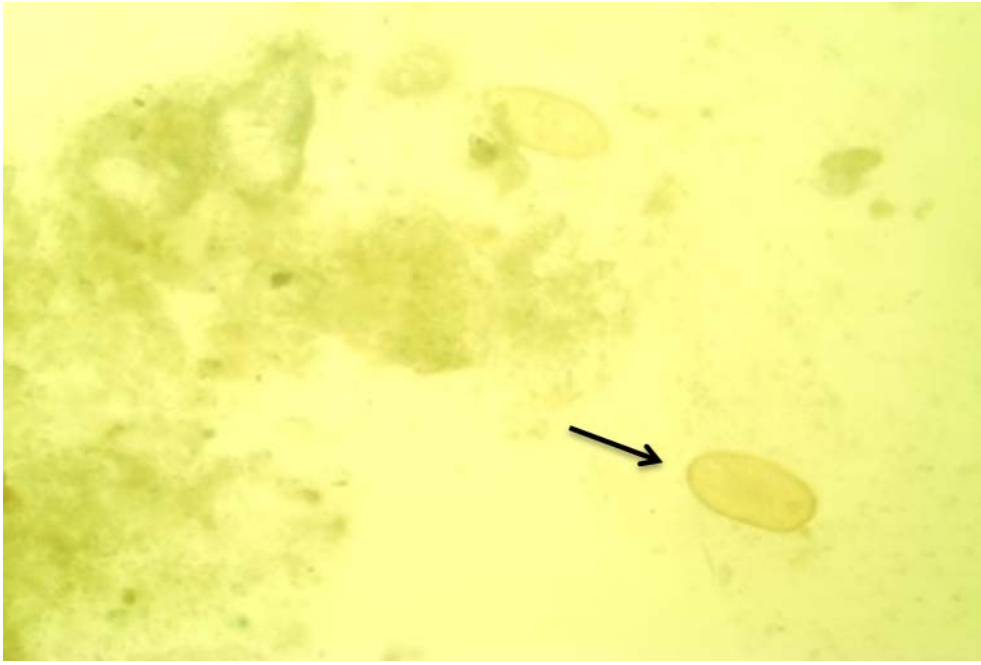

Figure 2 : Egg of *Fasciola* species: yellowish egg (arrow)

4. Discussion

The present study revealed an overall prevalence of bovine fasciolosis in the examined area of 49.21%, which is consistent with the findings of several previous studies. For example, Tsegaye et al. [25] reported a prevalence of 41.41% in Woreta, while Demssie et al. [26] observed a higher prevalence of 54.5% in Jimma. In similar regions, Eshetu et al. [27] in Angacha Woreda, Ayelign and Alemneh [28] in the North-East Amhara Region, and Mohammed et al. [29] in Eastern Shoa, Kuyu District, recorded prevalence rates of 40.62%, 47.10%, and 54.2%, respectively. The consistency of these findings across various studies highlights the widespread nature of bovine fasciolosis in Ethiopia, which may be attributed to common agro-ecological factors such as the prevalence of intermediate hosts like *Lymnaea* snails, and practices like communal water usage and irrigation that facilitate the contamination of pastures and water sources [30].

Conversely, some regions in Ethiopia reported lower prevalence rates. For example, studies conducted in Soddo (Southern Ethiopia) [9], Nekemte (East Wollega Zone) [31], and Wolaita Soddo (Southern Ethiopia) [32] recorded prevalence rates of 4.9%, 15.9%, and 15.9%, respectively. Other studies in Mecha District, West Gojam Zone (31.5%) [35], Zenzelma, Bahir Dar (26%) [1], and Bahir Dar

(32.3%) [16] also observed moderately lower rates. The differences in prevalence can be attributed to various factors, including differences in altitude, topography, climate, and the implementation of disease control practices. These factors influence the abundance of snail hosts and the effectiveness of anthelmintic treatment programs, as well as pasture management practices [42].

Within the study area, there were notable variations in the prevalence of fasciolosis across different locations. Sebatamit recorded the highest prevalence at 61.84%, followed by Kebele 11 (59.37%), Tikurit (50%), and Latammba (27.65%). These findings align with previous studies [16, 17, 27, 36, 38, 40], which also found significant regional differences in prevalence. Factors such as climatic conditions (e.g., altitude, rainfall, and temperature), animal management practices, and access to veterinary services and medication may contribute to these variations [28].

In terms of body condition, cattle in poor condition exhibited the highest prevalence of fasciolosis (64%), followed by those in medium condition (50%) and fat cattle (26.96%). This is consistent with the findings of other studies [1, 17, 26, 27, 29, 30-32, 34, 35, 38-41]. The higher prevalence in cattle with poor body condition is likely due to malnutrition, chronic infections, and environmental stressors, all of which increase susceptibility to fasciolosis. Concurrent parasitic and non-parasitic infections may further compromise the body condition of affected cattle, making them more vulnerable to the disease [17]. However, some studies [15, 16, 33, 36, 37] did not report significant differences based on body condition, suggesting that other factors might influence disease susceptibility

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Regarding age, no significant differences in prevalence were observed between young (50.38%), adult (47.33%), and older cattle (50.47%). This finding aligns with several previous studies [1, 16, 25, 29, 30, 32, 36-39], which also found no significant variation in prevalence across different age groups. However, some studies [15, 27, 28, 33-35, 40, 41] reported significant differences, which may be due to variations in exposure levels or management practices that equally affect all age groups.

Sex did not appear to significantly impact the prevalence of bovine fasciolosis, with males showing a prevalence of 49.73% and females 48.73%. These results suggest that both sexes are equally susceptible to the disease, in line with previous research [1, 15, 16, 25, 28, 32, 34-38]. However, a few studies [27, 29, 33] observed variations in prevalence between sexes, likely due to differences in management practices or environmental conditions.

Breed was not found to significantly influence fasciolosis prevalence, with local breeds showing a prevalence of 51.62% and crossbreeds a rate of 46.15%. This result is consistent with studies that found no significant differences in prevalence based on breed [1, 30, 32]. However, some studies [15, 25, 31] reported variations in prevalence among breeds, which may be linked to genetic factors or other unknown factors related to breed-specific characteristics. The lack of significant differences in the present study suggests that both local and crossbred cattle are equally exposed to risk factors for fasciolosis [1].

5. Conclusion

In conclusion, the study highlights significant variations in the prevalence of bovine fasciolosis based on location and body condition, while no significant differences were observed among age, sex, and breed groups. These findings emphasize the importance of location-specific interventions and proper management of cattle health to control the spread of fasciolosis.

Data sharing statement

Data is provided within the manuscript.

Ethical Statement

Not applicaple

Author Contributions

Tesfaye Mesfin: writing – review & editing, writing – original draft, resources, formal analysis, investigation, conceptualization, methodology, validation. Theobesta Solomon: writing – review & editing, resources, validation, methodology, visualation. Abraham Belete Temesgen: writing the original draft, review editing, funding accusation, resources, methodology, investigation, conceptualization, formal analysis, supervision and data curation. All authors read and approved the final manuscript.

Finding

None

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Declarations

Conflict of interest The authors declare that they have no competing interests or other interests that might be perceived to influence the results and/or discussion reported in this paper. Also, there are no known competing financial interests or personal relationships that could have appeared to influence the work reported in this work.

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