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Research Article

Prevalence of *Paramphistomum* infection and associated risk factors in cattle slaughtered at Dessie municipal abattoir, South Wollo zone, northeast, Ethiopia

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Abstract

Paramphistomum infection in domestic ruminants has received limited attention in Ethiopia, mainly due to the misconception that it causes minimal economic loss. However, it is widely distributed and contributes significantly to reduced productivity, particularly in areas with waterlogged or marshy grazing lands. This study aimed to estimate the prevalence of bovine *Paramphistomum* infection and identify associated risk factors in cattle slaughtered at the Dessie Municipal Abattoir, South Wollo Zone, Northeast Ethiopia. A cross-sectional abattoir-based study was conducted from November 2024 to May 2025. Cattle of both local and crossbreeds were systematically selected from highland, midland, and lowland areas. Routine ante-mortem and post-mortem examinations were performed, and data were analyzed using SPSS version 20. Chi-square tests were applied to assess associations between infection and potential risk factors at a significance level of $p < 0.05$. Out of 384 examined cattle, 174 (45.57%) were positive for *Paramphistomum* infection. Organ-level infection was 28.64% in the rumen, 5.47% in the reticulum, and 11.46% in both. The highest prevalence occurred in cattle with poor body condition (61.32%) and those from highland areas (49.65%). Older animals (51.63%) and females (64.58%) were more affected. Statistically significant differences ($p < 0.05$) were observed with sex, age and body condition. The study reveals a high prevalence of bovine *Paramphistomum* infection in Dessie, indicating its economic and veterinary importance. Integrated control strategies anthelmintic use, snail control, and farmer education are essential to reduce its impact.

Keywords: Abattoir, Cattle, Dessie, *Paramphistomum*, Prevalence, Risk Factor

1. INTRODUCTION

Ethiopia is characterized by an extremely diverse landscape, with a wide variety of climatic conditions and numerous agro-ecological zones that support a vast animal population

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(Zhongming *et al.,* 2013). The country hosts the largest livestock population in Africa, comprising approximately 65 million cattle, 40 million sheep, 51 million goats, 8 million camels, and 49 million poultry (CSA, 2020). Despite this large population, Ethiopia has not fully benefited from its livestock sector due to several limiting factors. These include malnutrition, recurring droughts, infrastructural limitations, traditional and suboptimal husbandry practices, poor genetic potential, widespread diseases of different etiologies, and an inadequate policy framework for disease prevention and control (Begna et al., 2024; Bayou & Geda, 2018).

Among the major constraints to cattle production and welfare are parasitic infections, particularly those caused by endoparasites such as flukes and gastrointestinal nematodes (Kowalczyk *et al.,* 2018). Trematodes, in particular, represent a significant challenge in Ethiopia, affecting both animal health and productivity. These parasites pose not only veterinary concerns but also potential zoonotic risks and cause substantial economic losses through morbidity, mortality, reduced meat and milk yields, compromised hides and wool, and costs associated with treatment and prevention (Yilma & Mesfin, 2000).

One of the important parasitic diseases in grazing livestock systems is *Paramphistomum* infection, caused by members of the family Paramphistomidae. These flukes typically measure 5–12 mm in length and 2–4 mm in width, with a characteristic conical shape. Adult parasites inhabit the rumen and reticulum, whereas immature stages are commonly found in the small intestine and abomasum (Harizt *et al.,* 2021; Pfukenyi & Mukaratirwa, 2018). *Paramphistomum* infection poses a serious threat to animal health and productivity, especially in grazing-based systems. It affects domesticated ruminants and leads to substantial economic losses in both meat and dairy production. The disease is considered a neglected tropical parasitic condition, with high prevalence across temperate, tropical, and subtropical regions—including Africa, Asia, Europe, and Australia (Roy & Lyndem, 2019).

Favorable climatic conditions support the growth of freshwater or mud snails that serve as intermediate hosts in the parasite's life cycle (Gordon *et al.,* 2013; Hajipour *et al.,* 2021). Early developmental stages (sporocyst, redia, cercaria) occur within the snail. Domesticated and wild ruminants become infected with *Paramphistomum* by ingesting metacercariae present on contaminated pasture or in water, following the parasite's development in freshwater snails (Nyagura *et al.,* 2024). Cattle are particularly susceptible to chronic *Paramphistomum* infection

due to the widespread use of pasture-based production systems in Ethiopia. The occurrence and severity of infection depend on host susceptibility and the number of metacercaria ingested (Sargison *et al.,* 2016). Several species of *Paramphistomum* have been documented in different ecological regions of Ethiopia (Vorster *et al.,* 2012).

Paramphistomum infection contributes to poor feed conversion efficiency, weight loss, reduced milk and meat production, increased treatment costs, and greater labor demands for managing infected animals (Huson *et al.,* 2017). Mortality is particularly high in young animals, whereas adults may develop partial immunity. However, naive adults can still exhibit clinical or subclinical disease when exposed to large numbers of metacercaria (Khan, 2008). Species-level identification of *Paramphistomum* remains challenging, and many studies fail to specify the exact species responsible—despite the importance of such information for parasite control in tropical regions (Tehrani, 2015).

A thorough epidemiological understanding of *Paramphistomum* infection, including its distribution, host–parasite interactions, and associated risk factors, is essential for developing effective and sustainable control strategies (Torres et al., 2008). Although several studies have reported the prevalence of P*aramphistomosis* in Ethiopia, comprehensive and up-to-date information remains limited. Furthermore, no documented study has investigated the occurrence of *Paramphistomum* infection in cattle slaughtered at the Dessie Municipal Abattoir. Therefore, this study was conducted to estimate the prevalence of *Paramphistomum* infection in slaughtered cattle and to assess the potential risk factors associated with bovine *Paramphistomosis* in the study area.

2. MATERIAL AND METHODS

2.1 Study Area

The study was conducted from November 2024 to May 2025 in the Dessie Municipal abattoir of Dessie town. Dessie is a town found in north-central Ethiopia, located in the South Wollo Zone of the Amhara Region, 400 km north of the capital city Addis Ababa (Figure 1). It located at a latitude and longitude of 11°8′N 39°38′E to 11.133°N 39.633°E, with an elevation between 2,470 and 2,550 meters above sea level. The mean annual rainfall of Dessie town ranges from 1,100 to 1,200 mm and the annual minimum and maximum temperatures of the town are 9 and

23.7◦C, respectively. With regard to Kombolcha town, the annual minimum and maximum temperatures are 12.9 and 28.1◦C, respectively (Eskinder et al., 2010; Abebe et al., 2023).

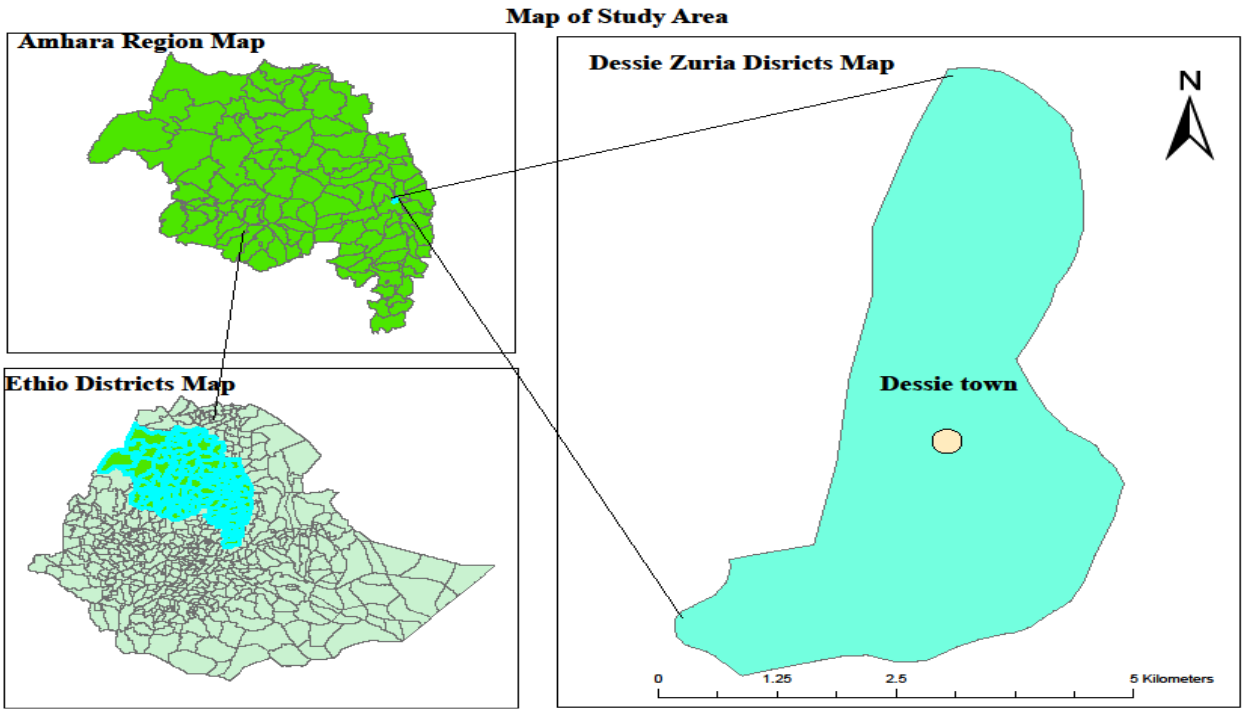


Figure 1. Map of the study area

2.2. Study population

Study populations were cattle of different breed (cross, local), body condition score and age brought from different agro ecological origin (highland, midland and lowland) to the abattoir for meat production. Animals brought to the abattoir were originated from the Oromia Special Zone, South Wollo, North Wollo and Afar regions. Animal body conditions were categorized as poor (score 2 to 3), medium (score 4 to 6), and good (greater than 6), by observing the anatomical parts such as the vertebral column, ribs, and spines (Nicholson and Butterworth (2008). Tooth eruption and wear were used to determine the age of the study animals. Animals were divided into groups based on their age; <4 years, 4–7 years, and > 7 years (young, adult and, old) respectively (Nega *et al.,* 2023).

2.3. Study design and period

A cross-sectional study design with systematic random sampling technique was conducted from November 2024 to May 2025 to estimate the occurrence of *Paramphistomum* infection in cattle slaughtered at Dessie Municipal Abattoir.

2.4. Sample size determination and sampling technique

Since no study was conducted on the area before, 50% expected prevalence of bovine *Paramphistomum* infection was considered with 95% confidence interval and 5% precision. Therefore, the relevant formula for the desired sample size was based on Thrusfield (2007) as follows:

$$N = \frac{(Z\alpha/2)^2 \times P(1-P_{exp})}{d^2}$$

Where: N= required sample size, Zα/2= the Z (normal distribution) value for a chosen confidence level, P_{exp}= expected prevalence, and d = desired absolute precision

$$N = \frac{1.962\ (0.5)\ (1-0.5)}{(0.05)^2} = \frac{3.84 \times 0.25}{0.0025} = 384$$

As a result, 384 cattle were selected and examined. Accordingly, a total of 384 cattle were sampled to determine the current prevalence of bovine *Paramphistomum* infection and assessment of its associated major risk factors in the study area.

Systemic random sampling technique was used to select the study units which mean the study animals units were selected in a way that the first was taken randomly and the rest were selected in 4th round and all the individual antemortem and postmortem observational findings was recorded on the prepared data recording format.

2.5. Data Collection Methods

2.5.1. Ante mortem examinations

Antemortem examination was conducted on animals prior to slaughter to assess and record their general health status. During each sampling session, individual animal was identified using their own identification number. During antemortem examination, general physical examinations of animals were conducted; detail records about the breed, age, origin and body condition of the animals were recorded.

2.5.2. Postmortem examination and identification

During postmortem examination, the rumen and reticulum were systematically inspected for the presence or absence of adult *Paramphistomum* and to assess fluke burden using routine meat inspection procedures. This primarily involved secondary examination; when evidence of *Paramphistomum* was detected, it was recorded separately. Primary examination (visualization and palpation) alone was insufficient to determine infection status, whereas secondary examination involved making further incisions into the rumen and reticulum to enable detailed observation of the parasites. The collected flukes were washed in tap water to remove ruminal contents and debris, after which they were placed in Petri dishes and examined under a stereomicroscope to assess their morphology. Final identification of *Paramphistomum* was based on key morphological features, including body shape, the large posterior ventral sucker (acetabulum), anterior sucker, terminal genital opening, and tegumental papillae, following the standard guidelines described by Urquhart et al. (1996) and Tandon et al. (2019).

2.6. Data Management and Analysis

Data obtained from field and laboratory examinations were first coded and entered into Microsoft Excel spreadsheets to ensure organization and accuracy. The cleaned dataset was then exported to SPSS version 20 (IBM Corp., Armonk, NY, USA) for statistical analysis. Descriptive statistics were used to summarize the data, while chi-square (χ^2) tests assessed associations between *Paramphistomum* infection and risk factors (age, breed, body condition, and agroecological zone). Statistical significance was considered at $p < 0.05$ with a 95% confidence level.

3. RESULTS

3.1. Prevalence of *Paramphistomum* infection in slaughtered cattle in Dessie municipal abattoir

Among the 384 cattle examined postmortem, 175 were infected with *Paramphistomum* spp., resulting in an overall prevalence of 45.57% (95% CI: 40.59%–50.55%). The parasites were predominantly recovered from the rumen, with lower occurrence in the reticulum. Of the infected animals, 110 (28.65%) harbored the parasites in the rumen, 21 (5.47%) in the reticulum, and 44 (11.46%) in both organs. A highly significant difference was observed in the distribution of *Paramphistomum* spp. among the predilection sites ($\chi^2 = 380.001$, $P < 0.001$), indicating a

strong preference for the rumen (Table 1). This finding confirms that the rumen serves as the primary site of adult *Paramphistomum* spp. localization in cattle within the study area.

Table 1. Distribution of *Paramphistomum* spp. in predilection sites of cattle examined postmortem (n = 384)

Predilection site	No. of infected cattle (%)
Rumen only	110(28.65
Reticulum only	21(5.47)
Both rumen and reticulum	44(11.46)
Total infected	175(45.57)

The difference in predilection sites was statistically significant ($\chi^2 = 380.001$, $p < 0.001$).

3.2. Associated risk factors of *Paramphistomum* infection in slaughtered cattle in Dessie municipal abattoir

The prevalence of Paramphistomum infection was slightly higher in local breeds (45.60%) than in crossbreeds (43.13%). With respect to age, older cattle showed the highest prevalence (51.63%), followed by young animals (49.29%), while adult cattle exhibited the lowest prevalence (37.50%). Regarding agroecological origin, cattle from highland areas had the highest prevalence (49.65%), compared with those from midland (42.96%) and lowland (42.32%) areas (Table 2).

Analysis of the result on the basis of different variables was made. Statistically significant difference ($p<0.05$) of *Paramphistomum* infection prevalence was observed on the basis of sex and agro climatic zones (origins) of cattle.

4. DISCUSSION

Paramphistomum infection is a significant constraint to ruminant production and productivity worldwide (Vercruysse & Claerebout, 2001) and has been widely reported as a parasitic problem affecting cattle and other ruminants in many regions, including Africa (Malone & Yilma, 1999). The infection is particularly prevalent in areas favorable for the survival of intermediate snail hosts, which play a crucial role in the parasite's life cycle (Copeman & Copland, 2008).

The overall prevalence of *Paramphistomum* infection in slaughtered cattle at the Dessie Municipal Abattoir was 45.57% (95% CI: 40.59% – 50.55%). Although direct comparisons for this specific area are limited, the observed prevalence is similar to other abattoir-based studies in Ethiopia, including 40.1% at Debrezeit Industrial Abattoir (Sintayehu & Mekonen, 2012) and

41.5% at Nekemte Municipal Abattoir in East Wollega Zone (Biyansa and Adugna, 2019). Coprological studies have reported comparable prevalence, such as 45.83% at Andassa Livestock Research Center in Northwest Ethiopia (Yeneneh *et al.,* 2012) and 48.5% in and around Bahir Dar (Kassaye & Hana, 2018). Internationally, the prevalence recorded in the present study is comparable to the 41.1% prevalence reported in small-scale dairy farms in Tanzania (Keyyu et al., 2006) and 37.6% in Zimbabwe (Chingwena *et al.,* 2002).

Table 2. Prevalence of Bovine *Paramphistomum* Infection by Sex, Age, Body Condition, Origin, and Breed in Cattle Slaughtered at Dessie Municipal Abattoir, Ethiopia

Variable	Categories	No of examined	No of positive (prevalence in %)	Chi square	P-value
Breed	Local	333	152(45.6)	0.112	.750
	Cross	51	22(43.13)		
Age	Young	71	35(49.29)	6.863	.031
	Adult	160	60(37.5)		
	Old	153	79(51.63)		
Sex	Male	336	143(42.55)	8.221	.003
	Female	48	31(64.58)		
Body condition	Good	72	17(23.6)	49.902	.000
	Medium	97	27(27.83)		
	Poor	212	130(61.32)		
Origin	Highland	145	72(49.65)	1.782	.417
	Midland	128	55(42.96)		
	Lowland	**111**	**47(42.32)**		

However, higher prevalence rates have been reported in other countries, including 81.9% and 55.5% in traditional cattle production systems and large-scale dairy farms, respectively, in Tanzania (Keyyu et al., 2006), 51.6% in Zambia (Phiri et al., 2006), 70% in Korea (Lee & Lee, 1971), 52.5% in Sokoto, Nigeria (Abunza et al., 2008) and 64.6% in North-Central Nigeria (Elelu et al., 2016). These variations in prevalence may be attributed to differences in agroecological and climatic conditions, animal management systems, grazing practices, sample size, study design, diagnostic techniques, and the availability of suitable intermediate hosts, all of which influence the transmission dynamics and epidemiology of Paramphistomum infection.

Conversely, the prevalence observed in this study was higher than that reported in several other regions. Within Ethiopia, lower rates have been documented, including 10.2% at Holeta Agricultural Research Center Dairy Farm (Getahun *et al.,* 2017), 10.7% in Hawassa town (Mariam *et al.,* 2014). Similarly, lower prevalence has been reported internationally, such as 13.6% in Eastern Turkey (Sevimli *et al.,* 2005), 8.95% in Turkey (Ozdal *et al*., 2010), 21.9% in

Omdurman, Khartoum State, Sudan (Halla, 2015), 25.26% in the United Kingdom (Sargison et al., 2016), 7.3% in Egypt (Haridy *et al*., 2006), 28% in Thailand (Morakot & Sakchai, 2006), 5% in Malaysia (Khadijah *et al.,* 2017), and 33% in Tanzania (Nzalawahe *et al.,* 2014). These differences highlight the influence of ecological, climatic, and management factors, as well as variations in study design and sampling, on the prevalence of *Paramphistomum* infection. These wide variations in the prevalence of *Paramphistomum* infection are likely influenced by multiple factors, including host susceptibility, parasite biology, environmental and climatic conditions, and differences in livestock management practices. Additional contributing factors may include the use and effectiveness of anti-paramphistome drugs, the presence or absence of swampy grazing areas, the efficiency of deworming programs, and the season or timing during which the studies were conducted (Radostits *et al.,* 2007).

A slightly higher prevalence of *Paramphistomum* infection was observed in local breed cattle (45.6%) compared to crossbreeds (43.13%). This difference may be partially explained by the acquired immunity of local breeds, which are naturally exposed to the parasite over extended periods. Such immunity often manifests as reduced worm fecundity, with naturally infected local cattle producing fewer parasite eggs. Additionally, innate immunological differences between indigenous and crossbred cattle may contribute to this variation (Aylate *et al.,* 2017). However, statistical analysis in the present study revealed no significant association ($p > 0.05$) between cattle breed and infection. These findings are consistent with previous reports by Yeneneh et al. (2012) and Ayalew et al. (2016), which also found no significant differences in infection prevalence between breeds.

The prevalence of *Paramphistomum* infection was highest in cattle with poor body condition (61.32%), followed by those with moderate (27.83%) and good (23.61%) body conditions. This finding is consistent with the report of Adiss and Melaku (2012), indicating that malnourished animals are more susceptible to infection due to weakened immunity, which reduces their ability to resist parasitic infestations. Seasonal variation in infection was also observed, with the highest prevalence during the summer (48.04%), followed by autumn (41.28%) and spring (37.5%), although these differences were not statistically significant ($p > 0.05$). This contrasts with previous reports by Ayalew et al. (2013) and Uddin et al. (2006). The seasonal differences observed in this study may be attributed to unequal sample distribution across seasons or to

grazing practices, as cattle often access marshy or floodplain areas during summer, increasing their exposure to infective metacercariae and intermediate snail hosts.

Analysis by sex revealed that female cattle had a significantly higher prevalence of *Paramphistomum* infection (64.58%) compared to males (42.55%), with this difference being statistically significant ($p < 0.05$). This suggests that sex may influence susceptibility to infection. These findings contrast with studies from Ethiopia (Tilahun *et al*., 2014; Yeneneh *et al*., 2012), Nigeria (Abunza *et al.,* 2008) where sex was not a significant factor, but are consistent with results from Indonesia (Hambal *et al.,* 2020). The discrepancy may be explained by differences in sample size, livestock management systems, and grazing exposure, as males often graze outdoors more extensively while females are frequently kept indoors for dairy production (Balock & Arthur, 1985).

The prevalence of *Paramphistomum* infection was also analyzed according to agro-ecological origin. Cattle from highland areas showed the highest prevalence (49.55%), followed by those from midland (42.96%) and lowland (42.32%) zones. This higher prevalence in highland cattle may be attributed to the presence of permanent water bodies and favorable environmental conditions for the survival of intermediate host snails. The effect of cattle origin on infection prevalence was statistically significant ($p < 0.05$), indicating that agro-ecology plays an important role in disease distribution. However, these results contrast with findings from Kifleyohannes et al. (2015) and Ayalew et al. (2016), who reported no significant association between cattle origin and infection rates.

5. CONCLUSION AND RECOMMENDATIONS

The present study revealed that bovine *Paramphistomum* infection is highly prevalent in the study area, with an overall prevalence of 44.57%, and the rumen and reticulum were identified as the main sites of infection. Significant risk factors influencing infection included cattle breed, sex, body condition, season, and agro-ecological origin. Higher infection rates were observed in female cattle, local breeds, animals with poor body condition, those from highland areas, and during the summer season. These findings indicate that *Paramphistomum* infection poses a considerable challenge to cattle production and highlights the need for targeted interventions in areas favorable to the parasite and its intermediate host snails.

Based on the conclusions drawn from this study, the following recommendations are proposed:

- Veterinarians should actively raise awareness among livestock owners, provide guidance on strategic deworming programs, and advise avoiding grazing in waterlogged or snail-infested areas.
- An integrated control approach should be implemented, combining effective anthelmintic treatments with management of snail populations to reduce parasite transmission.
- Further research is recommended on the epidemiology and ecology of intermediate host snails to support the development of sustainable and targeted control strategies.

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Conflict of Interest

The authors declare no conflict of interests.

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Ethics Approval and Consent to Participate

The study was conducted at Dessie Municipal Abattoir using cattle presented for routine slaughter. No experimental procedures were performed on live animals and data were collected during routine ante-mortem and post-mortem meat inspection activities. Therefore, formal ethical approval was not required. Permission to conduct the study was obtained from the Dessie Municipal Abattoir management and authorities. Verbal consent was obtained from the abattoir management before the collection of animal-related information and the conduct of the study. All procedures were carried out in accordance with standard animal welfare and veterinary inspection practices.

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