Original Article

Prevalence of Paramphistomum and Its Associated Factors in Cattle Slaughtered at Boko Slaughterhouse, Fedis District, Eastern Hararghe Zone, Ethiopia

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ABSTRACT

Background: Bovine paramphistomosis is one of cattle's most important parasitic diseases, causing mortality and economic losses in various parts of Ethiopia.

Objectives: A cross-sectional study was carried out in the Fedis District from April 2019 to October 2020 to determine the prevalence of *Paramphistomum* and its associated factors in cattle killed at Boko slaughterhouse.

Methods: A total of 384 slaughtered cattle were selected by systematic random sampling. Then, a post-mortem examination of the rumen and reticulum was conducted to check the presence or absence of adult *Paramphistomum*. The parasite was examined macroscopically and microscopically to study the morphology of adult flukes.

Results: Of 384 examined cattle, *Paramphistomum* was found in 156(40.6%). Of the 156 positive samples, 52.34%, 33.06%, and 14.6% were infected with *Paramphistomum clavula*, *Paramphistomum cervi*, and mixed infection, respectively. In this study, the highest infection rate was recorded in the wet season. Among assessed factors, body condition and origin of animals had significant correlations (P<0.05) with infection.

Conclusion: This finding indicated the highest infection of *Paramphistomum* was recorded in cattle. Therefore, the farmers should practice mass deworming of animals using selected anthelmintic therapy for flukes.

Keywords: Abattoir, Boko, cattle, *Paramphistomum*, Risk factors

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Introduction

Ethiopia has the largest livestock population in Africa yet produces insufficient animal protein and other livestock products to meet the demand of its population. The livestock sector has been contributing a considerable portion to the country's economy and is still promising to rally around the country's economic development. However, Ethiopia's livestock production and productivity are low due to poor nutrition, reproduction insufficiency, poor breed improvement, management constraints, and prevailing diseases (Ayele et al., 2003). Among diseases, parasitism is a significant problem affecting livestock productivity worldwide. Amphistomosis is globally distributed, but the highest prevalence has been reported in tropical and subtropical regions, particularly Africa, Asia, Australia, Eastern Europe, and Russia. It is caused by digenetic flukes belonging to the family Paramphistomidae. The life cycle of these trematodes involves snails as an intermediate host (Huson et al., 2017).

The epidemiology of *Paramphistomum* infection in cattle is determined by several factors governed by parasite-host-environment interactions (Martinez-Ibeas et al., 2016). It is also influenced by the climatic requirement for egg hatching, development, and survival of the larvae in pasture (Ozdal et al., 2010). Adults *Paramphistomum* are found in the rumen and reticulum, while immature parasites are found in the duodenum. Adult *Paramphistomum* flukes parasitize mainly in the fore stomachs of cattle, causing irregular rumination, lower nutrition conversion, loss of body condition, decreased milk production, and reduced fertility rate (Getenet et al., 2016). Severe infections with many immature parasites migrating through the intestinal tract can cause acute parasitic gastroenteritis with high morbidity and mortality rates, particularly in young animals (Maitra et al., 2014; Huson et al., 2017).

Despite the aforementioned prevailing situation and many problems caused by gastrointestinal parasites, well-documented information on the prevalence of *Paramphistomum* in ruminants in Ethiopia is scarce. Also, there is no conducted research in the Fedis District. Knowledge of the prevalence and risk factors would help implement strategies and policies to control and prevent bovine paramphistomosis in the study area. Therefore, this study aimed to determine the prevalence and associated factors of *Paramphistomum* in cattle slaughtered in the study area.

Materials and Methods

Study area

The study was carried out in the Fedis District, Boko slaughterhouse. The district is located in Eastern Hararghe, Oromia Regional State, Ethiopia, at a geographical coordinate of 8° 49′ 43.3″N latitude and 42° 0′ 45.57″E longitude with an elevation of 1285 m above sea level. It is divided into three major agro-climatic zones: highland, mid-highland, and lowland. The district has two seasons, mainly the wet season from April to September and the dry season from October to March. The population's main occupation in these rural Kebeles is the mixed farming system. Livestock species include cattle, sheep, goats, donkeys, and poultry. The population's livelihood is 93.8% agro-pastoralist while the rest, 6.2% are urban dwellers (FDOA, 2020).

Study animals

The study animals were cattle (local breeds) of different sexes, age groups, and body conditions brought to the slaughterhouse from highland, mid-highland, and lowland areas. The body condition of animals was assessed by observing and palpating the body fat deposits under the skin around the base of the tail, spine, and hip. Accordingly, it was categorized into good, medium, and poor. The aging of the cattle was based on rostral dentition, as described by Lasisi et al. (2002). Cattle aged < 3 years were classified as young, while >3 were considered as adults. Sexual differentiation was based on the appearance of external genitals, as described by Yunusa et al. (2013).

Study design and sample size determination

A cross-sectional study was conducted in the Fedis District from April 2019 to October 2020 to determine the prevalence and associated factors of *Paramphistomum* in cattle slaughtered at Boko slaughterhouse using post-mortem examination. The number of cattle required for the study was calculated based on the formula given by Thrusfield and Christley (2018). The sample size was determined based on the expected prevalence of 50%, a confidence interval of 95%, and a desired precision level of 5%. We used the Equation 1:

1. $n=1.96^2[Pexp\ (1-Pexp)]/d^2$

, Where n denotes the required sample size, Pexp refers to expected prevalence, and d refers to desired absolute precision. Therefore, based on the above formula, 384 cattle slaughtered at Boko slaughterhouse were selected for this study.

Sampling methods

The samples were collected when the slaughtering process was conducted. A systematic random sampling technique was used to select the study animals, i.e. the first animal was taken randomly, and the following animals were selected at an interval of three.

Study methodology

During the ante-mortem inspection, my identification was carried out using a marker on the head of each study animal. General physical examinations of animals were conducted, and the sex, age, origin, and body condition of the animals were recorded. During the post-mortem examination, the rumen and reticulum of the selected animals were systematically inspected to check the presence of adult *Paramphistomum*. Provided their detection, they were recorded separately as positive. Then, secondary examination was conducted by further incisions of the rumen and reticulum. The detected parasite was examined macroscopically and microscopically to study the morphology of adult flukes. Final identification of *Paramphistomum* was made based on the morphology of flukes: shape, posterior sucker (acetabulum), anterior sucker, terminal genitalium, and tegumental papillae following the standard guidelines (Urquhart et al., 1996).

Data management and analysis

All the data collected from each slaughtered animal were entered into a Microsoft Excel spreadsheet and analyzed with SPSS software, Version 20. The chi-square test (χ^2) was used to show the association between different risk factors such as sex, age, body condition, and origin of animals. $P<0.05$ was considered to be statistically significant.

Results

Of 384 examined animals, 156(40.6%) were infected with a *Paramphistomum* (Table 1). Of them, 52.6% were infected with *Paramphistomum clavula* and 32.7% with *Paramphistomum cervi* (Table 2). The current finding showed that the infection was almost similar in both species of animals. However, it offers a slightly higher number in old than adult animals, but there was no significant difference ($P>0.05$) concerning the sexes and age groups

Table 1. Overall prevalence of bovine paramphistomosis

No.		(%)	95% CI
Cattle Examined	Positive Cases	Prevalence	
384	156	40.6	[35.6%, 45.6%]

Table 2. Prevalence of bovine paramphistomosis based on species distribution

Species	No. (%)	χ^2 (P)
	Prevalence	
P. clavula	82(52.6)	11.923 (0.01)
P. cervi	51(32.7)	
Mixed infection	23(14.7)	

Table 3. Prevalence of bovine paramphistomosis based on sex and age groups

Risk Factors	Variables	No.	No. (%)	χ^2 (P)
		Examined Cases	Positive Cases	
Sex	Male	291	117(40.2)	0.06 (0.146)
	Female	93	39(42.1)	
Age groups	Adult	284	109(38.4)	2.014 (>0.05)
	Old	100	47(47.2)	
	Total	384	156(40.6)	

Table 4. Prevalence of bovine paramphistomosis based on body conditions of animals

Body Condition	No.	No. (%)	χ^2 (P)
	Examined Cases	Positive Cases	
Good	90	30(33.3)	11.923 (0.01)
Medium	200	74(37.2)	
Poor	94	52(55.3)	
Total	384	156(40.6)	

Table 5. Prevalence of bovine paramphistomosis based on the origin of animals

Origin of Animal	No.	No. (%)	χ^2 (P)
	Examined Cases	Positive Cases	
Highland	140	71(50.7)	12.853(0.005)
Mid-highland	140	56(40)	
Lowland	104	29(28)	
Total	384	156(40.6)	

of animals (Table 3). This finding showed statistically significant differences (P<0.05) regarding the origin of the animals; the highest prevalence of *Paramphistomum* was recorded in cattle brought from the highland than mid-highland and lowland areas (Table 4). This finding showed a statistically significant difference (P<0.05) concerning the body condition of the animals; the highest infection was recorded in poor body-conditioned animals, followed by medium and good body conditions (Table 5).

Discussion

Of 384 selected animals, the overall prevalence of *Paramphistomum* was 40.6%, which is in line with the findings of Sintayehu and Mekonnen (2012) and Turuna and Adugna (2019) in Ethiopia and Al-Gaabary et al. (2009) in Egypt, who reported prevalence rates of 41.5%, 40.1%, and 38.92%, respectively. However, the current study found a higher rate of infection than studies conducted in Turkey, Ethiopia, and Germany by Ozdal et al. (2010), Tagesse et al. (2014), and Forstmaier et al. (2021), who reported lower rates of 8.95% and 6.7%, respectively. This finding was slightly lower than the 65.7% reported by Kifleyohannes et al. (2015) in Ethiopia and 91.16% reported by Chowdhury et al. (2019) in Bangladesh. This difference might be due to differences in sample size, season of the study, management system, and environmental conditions.

In this study finding, the two most common species of *Paramphistomum* were identified with a prevalence of 52.34% for *P. clavula* and 33.06% for *P. cervi*, whereas 14.6% of animals were positive for mixed infection of *Paramphistomum* species. This finding agrees with Ayalew et al. (2016), who reported the highest infection rate of *P. clavula* compared to other species. The highest infection rate of cattle with *Paramphistomum* spp. was observed in August and gradually decreased in October. This finding agrees with the previous finding by Nayab et al. (2017), who reported that the prevalence of *Paramphistomum* spp. was highest in cattle in March and the lowest in November. It has been described that the bionomic requirements for the breeding of Planorbis snails and the development of intramolluscan stages of flukes often reach the optimum threshold during the wet months (Radostits et al., 2000).

Sex and age were not significantly (P>0.05) associated with infection rate. This finding agrees with other findings in Iran and Ethiopia (Khedri et al., 2015; Turuna and Adugna, 2019). They reported insignificant differences between gender and age groups in cattle, similar to the finding from Bangladesh by Ahmad et al. (2020) and Azoro (2021), who reported the prevalence of gastrointestinal parasites was not significantly different in relation to the gender of animals. This finding is because all age groups and genders have the same chance to ingest the infective stage larvae during grazing and are equally susceptible to infection.

This finding reported that the highest infection rate was recorded in poor body conditioned animals than in medium and good. A significant difference (P<0.05) concerning body conditions was observed. In agreement with this finding, Tagesse et al. (2014) and Kifleyohannes et al. (2015) in Ethiopia reported significant differences (P<0.05) between the prevalence of *Paramphistomum* and body conditions. The result may be due to the difference in immunity of the host and the fact that cattle with good body condition are expected to be dewormed and resist infection than the others. It was similarly observed among the few cases we encountered with heavy fluke infestation that the animals appeared markedly emaciated with poor body conditions.

The current study finding showed that the highest prevalence of Paramphistomosis was recorded in cattle brought from highlands than in mid-highland and lowland areas of origin. There was a statistically significant difference (P<0.05) between the origin of animals. This finding agrees with Kifleyohannes et al. (2015) from Ethiopia, who reported significant differences in relation to the origin of animals. However, it was inconsistent with Getenet et al. (2016) in Ethiopia, who reported insignificant difference between the origin of animals. These discrepancies might be due to the differences in sample size, diagnostic technique, climate, ecology, and livestock management system (Khedri et al., 2015). In general, this study revealed that the highest prevalence of *Paramphistomum* infection was recorded in cattle in the study area and was based only on slaughtered animals, which may have some limitations on results.

Conclusion

In this study, *Paramphistomum* was found to be prevalent in cattle. This infestation will hinder livestock production by causing remarkable direct or indirect losses of livestock production and productivity in the study area. In the present study, an overall prevalence of 40.6% were infected by adult *Paramphistomum*. Age, sex, body condition, and origin of animals were assessed as risk factors for bovine paramphistomosis. Among the risk factors, animal body condition and origin were statistically significant associations (P <0.05) with the infection rate of *Paramphistomum*, but sex and age groups were not. Therefore, based on the above conclusions, the following recommendations were forwarded.

Cattle breeders should be educated to improve feed provision and grow cattle with good body condition to provide a sufficient level of resistance against infections.

Integrated strategies should be implemented to control and prevent infection using mass deworming animals by selected anthelmintics.

Further detailed epidemiological and seasonal studies should be carried out to design appropriate control strategies in this area.

Ethical Considerations

Compliance with ethical guidelines

All ethical principles are considered in this article. The participants were informed of the purpose of the research and its implementation stages. They were also assured about the confidentiality of their information and were free to leave the study whenever they wished, and if desired, the research results would be available to them.

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Conflict of interest

The author declared no conflict of interest.

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References

Ahmad, S., Rahman Chowdhury, S. H., Hossain, M., Rahman, M., & Rahman, M. (2020). The prevalence of gastrointestinal parasites in buffalo calves in Sylhet District of Bangladesh. *Iranian Journal of Veterinary Medicine, 14*(3), 221-230. [Link]

Al-Gaabary, M., Osman, S., & El-Tonoby, A. (2009). Studies on paramphistomiasis in Ruminants. *Kafrelsheikh Veterinary Medical Journal, 7*(1), 116-136. [DOI:10.21608/KVMJ.2009.107145]

Arowoloa, O. B., Mohammeda, B. R., & Oparaa, M. N. (2020). Prevalence of Paramphistomum species in Cattle Slaughtered at Gwagwalada Abattoir, Abuja, Nigeria. *Parazitologia; 54*(6), 514-521. [DOI:10.31857/S123456780606005X]

Ayalew, G., Tilahun, A., Aylate, A. Teshale, A., & Getachew, A. (2016.) A study on prevalence of paramphistomum in cattle slaughtered in Gondar Elfora Abattoir, Ethiopia. *Journal of Veterinary Medicine and Animal Health*, 8(8), 107-111. [Link]

Ayele, S., Assegid, M., Jabbar, M., Ahmed, M., Belachew, A. (2003). Livestock marketing in Ethiopia: A review of structure, performance and development initiatives. Socio-economics and policy research working paper no 52. Nairobi: International Livestock Research Institute. [DOI: 10.22004/ag.econ.182878]

Azoro, A. V. (2021). Investigations into prevalence of Paramphistomum cervi infections of ruminants in Abia State, Nigeria. *Journal of Entomology and Zoology Studies, 9*(4), 102-105. [Link]

Chowdhury, T. J., Hossain, M. T., Akhter, S., Uddin, M. B., Chowdhury, M., & Rahman, M. M., et al. (2019). Coproscopic and slaughter house study of paramphistomiasis in cattle at Sylhet division of Bangladesh. *The Journal of Advances in Parasitology, 6*(3), 35-40. [Link]

Fedis District Office of Agriculture (2020). Baseline data and general information of Fedis District, Eastern Hararghe Zone, Ethiopia. Fedis: Fedis District Office of Agriculture.

Forstmaier, T., Knubben-Schweizer, G., Strube, C., Zablotski, Y., & Wenzel, C. (2021). Rumen(Calicophoron/Paramphistomum spp.) and liver flukes (fasciola hepatica) in cattle- Prevalence, distribution, and impact of management factors in Germany. *Animals, 11*(9), 2727. [DOI:10.3390/ani11092727] [PMID]

Getenet, A., Alebachew, T., Alemu, A., Ayichew, T., & Abebaw, G. (2016). A study on prevalence of Paramphistomum in cattle slaughtered in Gondar Elfora Abattoir, Ethiopia. *Journal of Veterinary Medicine and Animal Health, 8*(8), 107-111. [Link]

Nayab, G., Muhammad, I., Niaz, S., Ali, Z., & Kattak, S. A. (2017). Prevalence of gastrointestinal parasite, Paramphistomum in domestic animals (Cows and Buffaloes) of district Swat and Charsadda, KP, Pakistan. *Journal of Entomology and Zoology Studies, 5*(3), 907-911. [Link]

Hajipour, N., Mirshekar, F., Hajibemani, A., & Ghorani, M. (2021). Prevalence and risk factors associated with amphistome parasites in cattle in Iran. *Veterinary Medicine and Science, 7*(1), 105–111.[DOI:10.1002/vms3.330] [PMID]

Huson, K. M., Oliver, N. A. M., & Robinson, M. W. (2017). Paramphistomosis of ruminants: An emerging parasitic disease in Europe. *Trends in Parasitology, 33*(11), 836–844. [DOI:10.1016/j.pt.2017.07.002]] [PMID]

Khedri, J., Radfar, M. H., Borji, H., & Mirzaei, M. (2015). Prevalence and intensity of Paramphistomum Spp. In Cattle from South-Eastern Iran. *Iranian Journal of Parasitology, 10*(2), 268–272. [PMID]

Lasisi, O. T., Ojo, N. A., & Otesile, E. B. (2002). Estimation of age of cattle in Nigeria using rostral dentition. *Tropical Veterinarian, 20*(4), 204-208. [DOI:10.4314/tv.v20i4.4485]

Maitra, A., Yadav, C. L., & Sanjukta, R. K. (2014). Seasonal prevalence of paramphistomosis in domestic ruminants in different agro-climatic zones of Uttarakhand, India. *Asian Pacific Journal of Tropical Disease, 4*(Supplement 2), 748-753. [DOI:10.1016/S2222-1808(14)60720-9]

Martinez-Ibeas, A. M., Munita, M. P., Lawlor, K., Sekiya, M., Mulcahy, G., & Sayers, R. (2016). Rumen fluke in Irish sheep: Prevalence, risk factors and molecular identification of two paramphistome species. *BMC Veterinary Research, 12*(1), 143. [DOI:10.1186/s12917-016-0770-0] [PMID]

Sintayehu, M., & Mekonnen, A. (2012). Prevalence and intensity of Paramphistomum in ruminants slaughtered at Debre Zeit Industrial Abattoir, Ethiopia. *Global Veterinaria, 8*(3), 315-319. [Link]

Ozdal, N., Ilhan, G. F., & Deger, S. (2010). Prevalence of Paramphistomum infection in cattle and sheep in Van province, Turkey. *Helminthologia, 47*(1), 20-24. [DOI:10.2478/s11687-010-0003-1]

Radostits, O. M., Gay C. C., Hinchcliff K. W., & Constable P. D. (2007). *Veterinary Medicine: A text books of the diseases of cattle, horse, sheep, pigs, and goats*. London: Elsevier Saunders. [Link]

Tagesse, G. M., Mohamed, A., Ibrahim, N., & Baye, D. (2014). Prevalence of fasciolosis and paramphistomosis in dairy farm and house hold in Hawassa Town. *European Journal of Biological Sciences, 6*(2), 54-58. [Link]

Thrusfield, M., & Christley, R. (2018). *Veterinary epidemiology*. New Jersey: Wiley. [Link]

Turuna, G., & Adugna, B. (2019). Prevalence of major bovine trematodes (fasciola and Paramphistomum) in Cattle Slaughtered at Nekemte Municipal Abattoir, East Wollega, Oromia Regional State, Ethiopia. *Journal of Biology, Agriculture and Healthcare, 9(7),* 1-5. [DOI:10.7176/JBAH/9-7-01]

Kifleyohannes, T., Kebede, E., Hagos, Y., Weldu, K., & Michael, M. G. (2015). Prevalence of Paramphistomosis in Ruminants in Ashenge, Tigray Ethiopia. *Acta Parasitologica Globalis, 6*(2), 83-86. [Link]

Urquhart, G. M., Armour, J., Duncan, J. L., Dunn, A. M., & Jennings, F. W. (1996). *Veterinary parasitology*. Oxford: Blackwell Science Ltd. [Link]

Yeneneh, A., Kebede, H., Fentahun, T., & Chanie, M. (2012). Prevalence of cattle flukes infection at Andassa Livestock Research Center in north-west of Ethiopia. *Veterinary Research Forum: An International Quarterly Journal, 3*(2), 85–89. [PMID]

Yunusa, A. J., Salako, A. E., & Oladejo, O. A. (2013). Morphometric characterization of Nigerian indigenous sheep using multifactorial discriminant analysis. *International Journal of Biodiversity and Conservation, 5*(10), 661-665. [Link]