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Investigation of Adult *Paramphistomum* and Indigestible Foreign Bodies in the Fore Stomach of Cattle Slaughtered in Gondar Elfora Abattoir, Ethiopia

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ABSTRACT

Background and Objective: *Paramphistomum* is an emerging gastrointestinal fluke that importantly affects livestock health and production worldwide. Thus, the current study was conducted to assess the prevalence and intensity of *Paramphistomum* and foreign bodies and to identify associated factors for, slaughtered cattle in Gondar Elfora Abattoir. **Materials and Methods:** A cross-sectional study was conducted to assess the prevalence of adult *Paramphistomum* and to identify foreign bodies and associated risk factors in the forestomach of cattle slaughtered at Gondar Elfora Abattoir. Routine postmortem examination of the gastrointestinal tract was done on 384 cattle. **Results:** The overall prevalence of adult *Paramphistomum* in the forestomach of cattle was 24.7% (95/384), with higher rates in poor body-conditioned (39.1%) and old-aged cattle (26.3%). Gastrointestinal foreign bodies were found in 36.5% (140/384) of cattle, with plastic bags (12.2%) being the most common, followed by cloth (6.8%) and rope (4.2%). Foreign bodies were more frequent in old-aged (87.6%) and poor body-conditioned cattle (57.1%), with the rumen being the primary site (72.8%). Poor body condition significantly increased susceptibility to both *Paramphistomum* infection and foreign body lodgment ($p<0.05$). **Conclusion:** Those animals' high exposure to foreign bodies and *Paramphistomum* was expected from the increased pollution of grazing land mainly by plastic bags and weak antihelmintic activities. Thus, control measures on targeting the *Paramphistomum* and its life cycle, and environmental protection from pollution through proper disposal of the indigestible waste should be implemented.

KEYWORDS

Abattoir, cattle, foreign body, forestomach, *Paramphistomum*

INTRODUCTION

Ethiopia is a resource-rich nation in Africa with a sizable cattle population and it is roughly estimated to host 57.83 million cattle. Despite this large cattle population, livestock production and productivity in Ethiopia are low due to the challenges; of feed scarcity, reproduction inefficiency, poor management activities, and numerous animal diseases[1]. Helminth parasite infections are principal factors hindering

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livestock production and productivity[2], and gastrointestinal trematode are the major parasites infecting cattle in Ethiopia. Due to these diseases, which include reduced meat and milk yields, organ condemnations, draught power reductions, reproductive failures, and animal losses from deaths are the commonly documented bad sides in the cattle industry besides its zoonotic effect on humans[3,4].

In many regions of Ethiopia, bovine paramphistomosis is one of the most significant parasitic diseases affecting cattle caused by the parasite *Paramphistomum*, which results in mortality and significantly reduced productivity[5]. *Paramphistomum* is the major helminth parasitizing the forestomaches (rumen and reticulum) in sheep, goats, cattle, and water buffaloes. Animals that have a mild parasite infection do not suffer significant harm, however, a large rate of morbidity and mortality still can result from an enormous number of immature *Paramphistomum* migrating through the intestinal tract and causing acute parasitic gastroenteritis[6,7]. The feeding nature of this parasite; plugging on the wall of duodenum and ileum causes hemorrhage which leads to bleeding and diarrhea in animals. Anemia could result from this ongoing bleeding and further weaken the host. Additionally, ruminitis, irregular rumination, thriftiness and loss of body condition, decreased milk supply, and decreased fertility were recorded in cattle due to adult *Paramphistomum* infections[8].

In both the lowland and highland areas of the Amhara Regional State, paramphistomosis is the most important disease and causes significant financial loss in milk and meat production, reduced weight gains, expense for treating sick animals, and high fatality rate among young animals[9]. This infection has been more described in lowland and frequently flooded habitats, around lakes and marshlands[10], and the overcrowding of animals at grazing and watering points as a result of feed and watering scarcity may favor the establishment and spread of paramphistomosis[11]. Disease outbreaks typically happen during the drier months of the year and dispersal of snails by flooding events and changes in farm-management practices may be responsible for the apparent emergence of the parasite. The prevalence of paramphistomosis is high throughout tropical and subtropical regions, particularly in Africa, Asia, Australia, Eastern Europe, and Russia[12].

A gastric foreign body is any item that is present in the forestomach without passing into the small intestine[13]. One of the most frequent surgical emergencies in veterinary medicine is intestinal foreign substances. Because they are more likely to consume chopped meals and exhibit prehension without oral discrimination, cattle are more prone to foreign body syndrome than small ruminants. Cattle that have indigestion of foreign bodies suffer significant losses due to high rates of sickness and mortality, making it a pathological disease of economic importance[14,15].

Urban and suburban ruminants may be exposed to indigestible items including metal, leather, and plastic. These may cause impaction, ultimately with interference of the flow of ingesta leading to rumen distension and the absence of defecation[16,17]. The majority of affected animals are dairy cattle (87%), and those 93% are older than two years of age[18]. Dairy cattle are thought to be more frequently impacted in foreign bodies than beef cattle since they are more likely to feed chopped feed like hay or silages. This condition is usually sporadic but outbreaks have occurred when sources of wire have become mixed in to feed supplies[19].

Ingested foreign bodies by buffaloes and cattle are divided into two main groups' foreign bodies of metallic origin and foreign bodies of non-metallic origin. On the other hand, foreign bodies recovered from trans-ruminal exploration during rumenotomy are penetrating (nails and wires) and non-penetrating foreign bodies (polythene bags plastic material, leather, rope, and Raber)[20].

Traumatic reticulo-peritonitis (TRP) is a relatively common disease in adult cattle caused by the ingestion of penetrating foreign bodies and migration of this ingesta in the reticulum. The affected cattle encountered a pathological lesion of penetrated diaphragms and pericardium, that can have clinically

manifested with muffled heart sounds, distention of jugular veins, submandibular brisket, and ventral abdominal edema[6]. Entrance and migration of these foreign bodies through the body tissues lead to many complications that differ according to the nature of the foreign bodies and the way of their entrance into the tissue[21].

The majority of the pathological diseases that affect cattle's stomachs are caused by these foreign materials, which were primarily detected in the fore-stomachs. The presence of foreign bodies in ruminant forestomachs has drawn attention and been a topic of discussion globally since it results in decreased animal production as well as deaths[17,21]. Despite their significance, the studies about *Paramphistomum* parasite infections and foreign bodies in cattle slaughtered in Gondar town are limited. Similarly, the extent of the foreign body problem had not been given much attention. Thus, the current study was conducted to determine the prevalence and intensity of *Paramphistomum* and identify the types of foreign bodies and associated risk factors in slaughtered cattle in Gondar Elfora Abattoir.

MATERIALS AND METHODS

Study area: This research was conducted at Gondar Elfora Abattoir, from December, 2021 to March, 2022 situated in Central Gondar, Amhara Ethiopia. The town of Gondar is located 750 km from Addis Ababa and stands at 2200 m above sea level with a coordinate of 12°36 N, Longitude 33°28 E. The yearly average temperature is 19.7°C, and the rainfall ranges from 880 to 1172 mm. There are two distinct seasons in the area: Rainy season, which runs from June to September, and the dry season, which runs from October to May. Additionally, a mixed farming system that produces both crops and cattle is the main means of subsistence. The livestock population of 200,135 cattle, 81,000 goats, 70,000 sheep, 9,000 horses, and 12,000 donkeys are expected to be kept in the area[11].

Study animals: All cattle slaughtered at Gondar Elfora Abattoir within the study period were examined for the presence of adult *Paramphistomum* and foreign bodies in the fore stomachs. A systematic random sampling technique was employed to select the study animals. In this study, Thursfield's[22], the formula was used to determine the sample size, with a 50% expected prevalence, a 5% desired level of precision, and a 95% confidence interval as there were no previous study reports:

$$n = \frac{1096^2 \times Pexp\ (1 - Pexp)}{d^2}$$

Where:

n = Required sample size
Pexp = Expected prevalence
d = Desired absolute precision

Accordingly, a total of 384 animal cattle were involved in this study. Data related to body condition scores, organs (lodgment site), sex, and ages of animals were recorded. The animals' body condition scoring was categorized into three classes; poor, medium, and good based on Mushonga *et al.*[21].

Study design: A cross-sectional study was conducted from December, 2021 to March, 2022 to estimate the prevalence of adult *Paramphistomum* and assess the occurrence of foreign bodies in the forestomach of cattle slaughtered at Gondar Elfora Abattoir.

Study methodology

Ante-mortem examinations: Antemortem examinations of all animals were performed in holding pens of the Abattoir and required information regarding the health status, age, sex, and body condition of cattle were recorded.

Post-mortem examinations and content identification: After slaughter, the forestomach (comprising the rumen, reticulum, and omasum) was carefully removed from the abdomen cavity and placed in a container in a way as to minimize spillage of contents from the different chambers. Each rumen, reticulum, and omasum were incised, opened, and given a thorough gross examination by visual inspection and palpation for the presence of foreign materials and Adult *Paramphistomum* parasites. All the contents in each of the different chambers were examined thoroughly and the observed adult *Parampistomum* and the type of foreign materials (bodies) in each chamber were recorded. In addition, the morphology of the *Paramphistomum* parasite; shape, anterior sucker, posterior sucker (acetabulum), tegumental papillae, and terminal genitalia were appreciated using a stereo microscope (Eident, Hamburg, Germany) and preserved using 10% formalin.

Data management and analysis: The raw data obtained from each cattle was recorded in its age, and body condition scores and identified by a unique identification number. All data was recorded using Microsoft Excel spreadsheets. The data was analyzed using SPSS version 20 and the chi-square test was used to compute the presence of any association between the *Paramphistomum* parasite and foreign bodies with the hypothesized factors (age, organ type, and body condition score). In this study, $p<0.05$ were considered as statically significant.

Ethical approval: All the study activities in this work were conducted based on ethical standards after ethical approval from the Jigjiga University Research Ethics Review Committee Reg. No. (JJU-RERC 08/2021). Ante-mortem Examinations, investigators treated animals kindly and took proper care by minimizing discomfort, distress, or pain. They assumed that all procedures that would cause pain in human beings may cause pain in study animals.

RESULTS

Adult *Paramphistomum*: In this study, 384 cattle's gastrointestinal were examined post-mortem for the presence of adult *Paramphistomum*. Consequently, 24.7% (95/384) of adult *Paramphistomum* were identified from cattle harbored in the rumen (56, 58.9%), reticulum (22, 23.1%), and in both organs (17, 17.9%). The occurrence of adult *Paramphistomum* was statistically significant with the body condition score of animals ($\chi^2 = 18.3$, $p = 0.001$), and the highest prevalence was observed in poor body conditioned cattle 39.1% (45/115) than in good and medium body conditions 19.2% (20/104) and 18.2% (30/165), respectively. In addition, the prevalence of adult *Paramphistomum* parasites was a bit higher in old cattle 26.3% than in young, and adults 21.7 and 24.4%, respectively. However, the difference in prevalence of the parasite between the age groups and organs was not statistically significant ($\chi^2 = 0.55$, $p = 0.77$) (Table 1).

Foreign bodies in fore stomach

Types and proportion of individual indigestible foreign body: In this study, 140 (36.5%) cattle were found with foreign bodies in their forestomachs. Metallic objects; wire, nails, blades, and needles and non-metallic objects; plastic bags, rope, hair, and clothes were the identified foreign bodies. Plastic bags were the most commonly encountered foreign body 47 (12.2%) followed by Cloth 26 (6.8%), Rope 16 (4.2%), whereas, 5 (1.3%) in Stone, Needle, Nail, and 3 (0.8%) Blade were the lost recorded (Table 2).

Lodgment site: Of 140 positive cases for foreign bodies, 102 (72.8%) has occurred in the Rumen while 33 (23.6%) in the Reticulum and 5 (3.8%) in Omasum (Table 3).

Prevalence of foreign bodies to animal age: In the case of foreign bodies to animal age, foreign bodies were encountered 17 (12.1%), 41 (29.3%), and 82 (87.6%) in young, adult, and old animals, respectively. In addition, the age categories were statistically significant ($\chi^2 = 15.24$, $p = 0.001$) for foreign body occurrence. Plastic bags 47 (12.2%) were the most frequently encountered foreign bodies followed by 26 (6.7%) and ropes 16 (5.2%) in the stomachs of all age categories (Table 4).

Table 1: Prevalence of adult *Paramphistomum* parasites according to age, BCS, and lodgment site

Animal factor	Categories	#Examined	#Positive	Prevalence (%)	χ^2	p-value
Age group	Young	60	13	21.7	0.55	0.77
	Adult	164	40	24.4		
	Old	160	42	26.3		
BCS	Poor	115	45	39.1	18.3	0.001
	Medium	165	30	18.2		
	Good	104	20	19.2		
Organ	Rumen	95	56	58.9	1.5	0.46
	Reticulum	95	22	23.1		
	Both	95	17	17.9		

Table 2: Types of foreign bodies and frequency of occurrence in cattle slaughtered at Gondar Elfora Abattoir

Types of foreign body	Frequency	Prevalence (%)
Plastic bags	47	12.2
Cloth	26	6.8
Rope	16	4.2
Wire	13	3.4
Hair	12	3.1
Sand	8	2.1
Stone	5	1.3
Needle	5	1.3
Nail	5	1.3
Blade	3	0.8
Total	140	36.5

Table 3: Prevalence of gastrointestinal foreign bodies to lodgment site

	Lodgment site			
Foreign bodies	Rumen	Reticulum	Omasum	Total
Plastic bags	38 (37.2%)	9 (27.3%)	-	47 (12.2%)
Cloth	26 (25.5%)	-	-	26 (6.7%)
Rope	15 (14.7%)	-	1 (20.0%)	16 (5.2%)
Wire	-	12 (36.4%)	1 (20.0%)	13 (3.4%)
Hair	11 (10.8%)	1 (3.0%)	-	12 (3.1%)
Sand	5 (4.9%)	-	3 (60.0%)	8 (2.1%)
Stone	5 (4.9%)	-	-	5 (1.3%)
Needle	-	5 (15.2%)	-	5 (1.3%)
Nail	-	5 (15.2%)	-	5 (1.3%)
Blade	2 (1.9%)	1 (3.0%)	-	3 (0.8%)
Total	102 (72.8%)	33 (23.6%)	5 (3.8%)	140 (36.4%)

Table 4: Prevalence of gastrointestinal foreign bodies to age of cattle

	Age category			
Foreign body	Young	Adult	Old	Total
Plastic bags	5 (29.4%)	16 (39.0%)	26 (31.7%)	47 (12.2%)
Cloth	5 (29.4%)	11 (26.8%)	10 (12.2%)	26 (6.7%)
Rope	1 (5.8%)	4 (9.7%)	11 (13.4%)	16 (5.2%)
Wire	2 (11.8%)	1 (2.4%)	10 (12.2%)	13 (3.4%)
Hair	2 (11.8%)	3 (7.3%)	7 (8.5%)	12 (3.1%)
Sand	1 (5.8%)	2 (4.8%)	5 (6.1%)	8 (2.1%)
Stone	-	-	5 (6.1%)	5 (1.3%)
Needle	-	3 (7.3%)	2 (2.4%)	5 (1.3%)
Nail	-	-	5 (6.1%)	5 (1.3%)
Blade	1 (5.8%)	1 (2.4%)	1 (1.2%)	3 (0.8%)
Total	17 (12.1%)	41 (29.3%)	82 (87.6%)	140 (36.4%)

Prevalence of foreign body with cattle body condition: Foreign bodies were more frequently encountered in animals with poor body condition scores 80 (57.1%) than the medium 35 (25.0%) and good body conditions 25 (17.8%). The statistical analysis revealed a significant difference among the body condition scores (χ^2 = 45.4, p = 0.001) in the occurrences of foreign bodies (Table 5).

Table 5: Prevalence of gastrointestinal foreign bodies to the body condition scores of cattle

	Body condition score			
Foreign body	Poor	Medium	Good	Total
Plastic bags	26 (32.5%)	12 (34.3%)	9 (36.0%)	47 (12.2%)
Cloth	15 (18.7%)	5 (14.9%)	6 (24.0%)	26 (6.7%)
Rope	12 (15.0%)	1 (2.8%)	3 (12.0%)	16 (5.2%)
Wire	8 (10.0%)	3 (8.6%)	2 (8.0%)	13 (3.4%)
Hair	6 (7.5%)	2 (5.7%)	4 (16.0%)	12 (3.1%)
Sand	3 (3.7%)	4 (11.4%)	1 (4.0%)	8 (2.1%)
Stone	3 (3.7%)	2 (5.7%)	-	5 (1.3%)
Needle	4 (5.0%)	1 (2.8%)	-	5 (1.3%)
Nail	2 (2.5%)	3 (8.6%)	-	5 (1.3%)
Blade	1 (1.3%)	2 (5.7%)	-	3 (0.8%)
No foreign body	80 (57.1%)	35 (25.0%)	25 (17.8%)	140 (36.4%)

DISCUSSION

The present study indicated that the overall prevalence of adult *Paramphistomum* parasites investigated at Gondar Elfora Abattoir was found 24.7% (95/384), harbored in the forestomach of cattle. This finding is in close agreement with the report of 23.8% by González-Warleta *et al.*[23]. On the other hand, this finding is higher than the prevalence of 20% in Egypt[24], 16.6% in India[25], and 13.6% in Turkey[26]. However, the current prevalence of *Paramphistomum* is relatively lower compared to 37.6% in Zimbabwe[12], 40.1% in Ethiopia-Debreziet[27], 42.1% in Tanzania[28], and 51.6% in Zambia[29], 78.38% in Thailand[30], and 96.43% in Indonesia[31]. The difference in the prevalence of *Paramphistomum* in these areas is influenced by differences in the hosts, parasitic agents, transmission process, and environmental effects[32]. In the current study, animals with poor body conditions had a higher intensity for *Paramphistomum* infection 39.1% (45/384), than medium and good body conditions, which agreed with the work of 82.5% by Sintayehu and Mekonnen[27].

In the current study, the overall foreign body prevalence was 36.5% (140/384), in cattle slaughtered at Gondar Elfora Abattoir. This finding was higher than the overall foreign body prevalence report of 12% by Ekpo[33] in Gwagwalada Abattoir, 13.22% by Desiye and Chanie[34] in cattle slaughtered at Jimma Municipal Abattoir, 23.9% in Hirna Municipal Abattoir[35], and 12.24% of Alleyo[36] in Shashemene Municipal Abattoir.

However, the current prevalence of foreign bodies is relatively low compared to the 40.1% in Bedeno-Ethiopia, 59.14% in Achai-Pakistan, and 77.41% in Jorda prevalence rates reported by Ame *et al.*[37], Anwar *et al.*[38], and Ismail *et al.*[18], respectively. The lower prevalence in this study can be attributed to the type of management system and relatively good feed availability, as most cattle owners supplement feeds with concentrates in times of feed shortages. The variation in the prevalence of rumen and reticulum foreign bodies could be due to the ingestion of foreign bodies linked to the shortage of forage and increased pollution of grazing land with indigestible foreign bodies.

The highest prevalence 37.5% of foreign bodies was detected in cattle in old ages (greater than 10 years). This finding is in close agreement with the work of Ismail *et al.*[18], from Jordan old dairy cows suffering from recurrent rumen tympany. The previous studies, Abraham *et al.*[39], Ame *et al.*[37], and Ismail and Al-Qudah[18] have also reported a higher prevalence of indigestible foreign bodies in older cattle than in young cattle. This high prevalence of indigestible foreign bodies in older cattle may be associated with prolonged exposure to the contaminated environment.

In this study, the foreign materials observed in poor body-conditioned cattle 50.4%, agreed with the work by Negash *et al.*[40], Ismail and Al-Qudah[18], and Remi-Adewunmi *et al.*[17], and this might be due to the contribution of the foreign bodies in the animals' weight loss after it has been exposed or it might be due to the interference of the foreign body with the absorption of volatile fatty acid which

causes for reduced weight gain. In addition, the result of this study showed that the majority of the foreign bodies 73/104 (70.2%) were lodged in the rumen. This finding is in close agreement with the report of 70.8% by Abraham *et al*.[39], and 68.9% by Duresa *et al*.[41]. The recovery of most foreign bodies in the rumen is also not surprising, as it has been reported previously in small ruminants[18,42,43] and in buffaloes[21,33]. This may be because almost all ingesta are first lodged into the rumen and might not processed to other stomach chambers.

Plastic bags 47 (45.2%) were the most frequently encountered in this study and this finding was in agreement with previous studies by Tehrani *et al*.[43], Ismail and Al-Qudah[18]. This might be due to animal exposure from thrown all over scattered plastic bags as commonly used for packaging different items in the absence of better means of disposal[35]. When cattle are grazed in such a contaminated environment, chances of picking the foreign body are high as was observed in the current study. In this study, wires 13 (12.5%) from metallic foreign material are also frequently encountered due to the source of wire having become mixed in feed supplies and this finding was in agreement with the report of Bassa and Tesfaye[15] 11.65%.

This study was limited to cattle from Gondar Elfora Abattoir, which may not represent the wider regional population, and it did not account for seasonal variations or risk factors such as feeding practices and environmental conditions. Additionally, the reliance on microscopic identification of *Paramphistomum* may have constrained species-level accuracy. Future studies should expand to multiple regions, incorporate molecular diagnostics, and assess seasonal and management-related risk factors. Developing intervention strategies, such as deworming and improved feeding practices, along with evaluating the economic impacts of these conditions, would provide comprehensive insights and practical solutions.

CONCLUSION

The present study conducted for the assessment of gastrointestinal adult *Paramphistomum* and foreign bodies in cattle slaughtered at Gondar Municipal Abattoir showed that both *Paramphistomum* parasites and foreign bodies were prevalently identified. Cattle with poor body conditions were recorded as more susceptible to *Paramphistomum* infection. Ingested plastic bags were the most frequently identified foreign bodies in the area and the foreign bodies were prevalently recorded in cattle with old age and poor body condition. The body condition score of the animals was the major factor for both *Paramphistomum* infection and foreign body occurrences instead, the age of the animal was exclusively affecting foreign body occurrence. The findings of this study proved that *Paramphistomum* infection and foreign bodies were significantly affecting cattle health and causing production losses. Thus, a strategic intervention approach integrating anthelmintic therapy with snail control, and proper management of disposable materials like plastic bags should carried out to combat the effect.

SIGNIFICANCE STATEMENT

This study investigates the prevalence and intensity of *Paramphistomum* infection and foreign bodies in cattle at Gondar Elfora Abattoir, Ethiopia. The findings highlight a significant health challenge for livestock with an overall prevalence of 24.7% for *Paramphistomum* and 36.5% for gastrointestinal foreign bodies. Notably, poor body condition and age were correlated with higher infection rates. The research underscores the dual threat of increasing environmental pollution, particularly from plastic wastes and insufficient anthelmintic treatments. These factors contribute to the vulnerability of cattle, necessitating targeted control measures for *Paramphistomum* and improved waste management practices to safeguard livestock health and enhance production in the region.

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