

Occurrence and Associated Risk Factors of Inedible Foreign Objects in Cattle Butchered at Dilla Municipal Abattoir, Southern Ethiopia

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Abstract

The purpose of the study was to assess the frequency of indigestible waste items in slaughtered cattle as well as related risk factors. From March to July 2024, the study was carried out on cattle killed at the Dilla Municipal Abattoir in the Gedeo Zone of Southern Ethiopia. The animals were evaluated using both ante-mortem and post-mortem inspections using a cross-sectional study design. Numerous foreign objects were found in the reticulum and rumen during these tests. 172 (44.79%) of the 384 killed animals had positive tests for foreign bodies. The prevalence of foreign bodies showed a significant difference based on the sex of the cattle ($\chi^2 = 7.07, p < 0.01$) and age categories ($\chi^2 = 6.01, p < 0.05$). Post-mortem results revealed that the most found foreign objects included plastics (21.5%), nylon clothes (20.93%), rope (13.95%), and iron/wires (11.63%). The rumen contained the majority of plastic materials, whereas the reticulum contained the majority of non-plastic items. Foreign bodies were more common in the rumen than in the reticulum ($\chi^2 = 7.3, p < 0.00$). Additionally, the prevalence of foreign bodies varied significantly across different age groups in relation to body condition ($\chi^2 = 7.95, p < 0.05$). These findings indicate that the ingestion of waste materials poses significant veterinary health challenges, leading to decreased production and productivity, which ultimately results in higher mortality rates in cattle managed under extensive systems. In conclusion, these results can inform the formulation of policies for solid waste management and strategies aimed at reducing environmental pollution while safeguarding animal health. Therefore, it is recommended that further surveillance and monitoring of organ condemnation at the Dilla abattoir be implemented to control the spread of zoonotic and other diseases.

Keywords/Phrases: Foreign body, Indigestible product, Plastic, Prevalence, Reticulum, Rumen

1 Introduction

The occurrence of inedible foreign objects in cattle, especially those intended for butchering, is an increasing concern worldwide (Thomas *et al.*, 2017). This issue encompasses various aspects of animal health, food safety, and economic implications within the livestock industry. In many developing nations, including Ethiopia, domestic animals are frequently exposed to indigestible foreign objects from multiple sources due to environmental contamination with undesirable solid materials (Abebe and Nuru, 2011). The widespread presence of these ma-

terials contributes to environmental pollution, and the ingestion of foreign objects poses a significant challenge to animal development in tropical regions (Gurara *et al.*, 2020). Ruminants are the most affected livestock in this regard.

The anatomy of ruminants' digestive systems leads to indiscriminate feeding habits, resulting in the ingestion of solid waste. Furthermore, the expansion of industrialization and agricultural mechanization has increased environmental pollution due to improper waste disposal, further elevating the risk of animals ingesting solid waste objects (Desiye and

Mersha, 2012; Jaja *et al.*, 2023). In developing countries, the ingestion of foreign bodies is particularly common, often exacerbated by substandard animal management practices. Nutritional deficiencies and feed shortages can also increase the likelihood of foreign body ingestion by animals (Duresa *et al.*, 2022).

The presence of foreign bodies in the forestomach of ruminants can trigger acute reticulo-peritoneal inflammation, leading to conditions such as peritonitis, pleuritis, and pericarditis. This results in significant production losses and, in severe cases, animal mortality (Ramprabhu *et al.*, 2002; Mekuanint *et al.*, 2017). Additionally, foreign bodies can impair the assimilation and absorption of volatile fatty acids, reducing body weight gain and hindering animal fattening.

Overall, this issue has substantial economic implications due to the marked decrease in milk and meat production, increased treatment costs, and higher mortality rates (Sileshi *et al.*, 2013). While there have been efforts in Ethiopia to study the prevalence of various infectious diseases, the problem of ingested foreign bodies has not received adequate attention as a distinct health concern. Moreover, in the study area, information about the prevalence and impact of indigestible foreign bodies in cattle is notably limited.

In order to address the health and digestive issues that cattle confront, this study concentrates on the frequency and location of indigestible foreign bodies in the fore-stomach (rumen and reticulum). In order to address foreign body ingestion in animal health and reduce environmental pollution, it will also be easier to design management protocols, preventive strategies, and policies if associated risk factors are identified. Assessing the frequency and distribution of indigestible foreign bodies and identifying associated risk factors in calves killed at the Dilla Municipal Abattoir are the goals of this study.

2 Materials and Methods

2.1 Study Area

The investigation was carried out at the Dilla Municipal Abattoir in Southern Ethiopia, which is 365 kilometers from Addis Ababa. With an average el-

evation of 1,570 meters above sea level, Dilla is located at latitude 6°24'30" N and longitude 38°18'30" E. Hawassa is about 90 kilometers away from the town. The Gedeo Zone has a mild, humid climate with mean annual temperatures between 17°C and 22.4°C and mean annual rainfall between 1,200 and 1,800 mm.

There are an estimated 102,624 people living in Dilla, with 50,286 men and 52,338 women. According to CSA (2021), there are 133,925 cattle, 197,846 sheep, and 22,621 goats in the Gedeo Zone.

2.2 Study Population

The investigation was carried out between March and July 2024 at the Dilla Municipal Abattoir on 384 butchered cattle of both sexes that appeared to be in good health. The livestock that were killed came from the midland and lowland agro-ecological zones and were housed under different management techniques. To determine the prevalence of swallowed inedible solid waste items, the animals were divided into groups according to breed, age, sex, and bodily condition.

2.3 Study Design

In order to determine whether solid waste elements were present in the rumen and reticulum of butchered cattle, a cross-sectional investigation was carried out at the Dilla Municipal Abattoir between March and July 2024. The study examined the cattle's breed, age, bodily condition, sex, and place of origin as possible risk factors. Based on dentition, age groups were categorized as young, adult, and old (Johnson *et al.*, 1997). Visual examination and lumbar vertebral palpation were used to evaluate the state of the body (Rabana *et al.*, 2022).

2.4 Sampling Technique and Sample Size Determination

The formula provided by Thrusfield (2005) was used to calculate the sample size. A required precision of 5% at a 95% confidence interval and an expected predominance of 50% were used to determine the test estimate. The following formula was used to determine the sample size:

$$N = \frac{(1.96)^2 P_{exp}(1-P_{exp})}{d^2}$$

Where, N = required sample size; P_{exp} = expected prevalence; d^2 = desired absolute precision.

Therefore, the minimum sample size of the present study was 384.

2.5 Method of Data Collection

Ante mortem examination

The cattle's age, sex, breed, and physical condition were evaluated through ante-mortem examinations. There were three age categories: young (less than five years), adult (five to ten years), and old (more than ten years). According to Nicholson and Butterworth (1986) and Mangun *et al.* (2024), body condition was classified as poor, medium, or good based on the animal's appearance and physical palpation of the spinal processes and transverse processes of the lumbar vertebrae. Breeds were classified as either local or crossbred, depending on the species of animal brought to the abattoir. The age of the animal was determined based on dentition, as outlined by Kelly (1975) and Mohammed *et al.* (2014).

Postmortem examination

Postmortem examinations were performed on both the rumen and reticulum to determine the presence or absence of ingested solid materials. After butchering, the stomach was carefully removed from the abdominal cavity and examined for foreign materials through palpation and visualization. Any foreign objects discovered during the examination were washed with clean water to facilitate observation and identification. The location and type of any solid waste found were recorded.

2.6 Data Analysis

The Statistical Package for Social Sciences (SPSS, Version 20) was used to evaluate the data after it was input into a Microsoft Excel worksheet. The findings were summarized using descriptive statistics like means and percentages. By dividing the total number of cattle found to have swallowed foreign bodies by the total number of cattle examined, the frequency of foreign bodies in the rumen and reticulum was computed as a percentage. The Pearson

chi-square (χ^2) test was used to investigate the relationship between possible risk variables and the occurrence of foreign bodies. A significant difference was defined as $P < 0.05$.

2.7 Ethical clearance

The study was approved in accordance with ethical principles regarding animal handling. It was conducted with safety and humanity to protect animal welfare and uphold research ethics. All relevant slaughterhouse rules and protocols were followed during the study. Before data collection, the Dilla Municipal Abattoir was fully informed of all aspects of the study in written form.

3 Results and Discussions

3.1 Solid indigestible materials in rumen and reticulum

A total of 384 butchered cattle at the Dilla Municipal Abattoir revealed a prevalence of 44.79%. This finding aligns with studies by Negash *et al.* (2015) in Haramaya and Shiferaw *et al.* (2014) in the Amhara region, which reported prevalence rates of 43.4% and 41.8%, respectively. Conversely, Ismael *et al.* (2007) identified a significantly higher prevalence of 77.41% among adult dairy cattle in Jordan. In contrast, Bassa and Tesfaye (2017) found a much lower prevalence of 17.16% at the Wolaita Sodo Municipal Abattoir in Ethiopia.

The higher prevalence rates observed in some studies may be attributed to various factors, including feed shortages and the lack of supplementary feeding during the extended dry season, which often leads livestock to consume inappropriate materials (Tesfaye and Chan, 2012). About 68.2% of the foreign bodies in the 172 positive instances were discovered in the rumen, 25.58% in the reticulum, and 6.4% in both organs. Although less than the 70.2% prevalence reported by Bitew (2025), this indicates a large presence of foreign bodies in the rumen. As the major digestive compartment, the rumen receives a significant amount of ingested feed, which raises the possibility of foreign body buildup. This could account for the greater prevalence of foreign bodies in the rumen seen in earlier research.



Figure 1. Disclosed organs from rumen, reticulum and both

The foreign bodies detected included plastics, nylon clothes, iron/wire, sacks, hair, leather, and combinations such as plastic plus cloth and plastic plus wire plus nails. These materials were frequently encountered among the positive cases in the study. This prevalence may arise from the widespread use of plastic for shopping, waste storage, and food packaging, which is often improperly disposed of in the environment, leading to consumption by free-grazing animals. Furthermore, the high percentage of plastic foreign bodies may be made worse by the absence of recycling businesses in the research region, which would increase the frequency of occurrences involving plastic in the rumen. Additionally, the rumen's structural nature makes it easier for certain ingested foreign bodies—especially plastic materials—to be retained (Tesfaye and Chan, 2012).

3.2 Occurrence of Foreign Body Based on Sex and Breed

In this study, among the 384 examined cattle, 162 (47.09%) were male and 25% were female. Of these, 311 were local breeds and 73 were crossbreds. Notably, the prevalence of foreign bodies in the rumen

and reticulum differed significantly between the two sexes and breeds ($P < 0.05$). Specifically, 47.6% of local breed cattle tested positive for foreign bodies, while only 32.9% of crossbred cattle showed similar results. Interestingly, female cattle exhibited a lower prevalence of foreign body ingestion compared to their male counterparts. This finding may be related to the practice of limiting the slaughter of female animals to those that are anestrus. This contrasts with a study by Bihon *et al.* (2020), which reported a higher prevalence of foreign bodies (17.22%) in female cattle compared to males at the Wolaita Sodo Municipal Abattoir in Ethiopia.

The higher occurrence of foreign bodies in local breeds (47.6%) compared to crossbreds (32.9%) could be attributed to the feeding practices associated with local breeds, which often involve more extensive grazing and greater exposure to environmental debris, thereby increasing the likelihood of foreign body ingestion. Overall, these findings provide valuable insights into the prevalence of foreign bodies in cattle based on breed and sex, highlighting the need for further research to explore the underlying factors influencing these differences.

Table 1. prevalence of foreign bodies based on sex and breed in the study area

Risk factors	Examined animals	positive animals	Prevalence	χ^2	P-value
Sex	Male	344	162	47.09	7.07 0.01
	Female	40	10	25	
	Total	384	172	44.79	
Breed	Local	311	148	47.6	3.86 0.05
	Cross	73	24	32.9	
	Total	384	172	44.79	

3.3 Prevalence of Foreign Body based on Age and Origin

Three age groups were created from the butchered cattle: ≤ 5 years (young), 5–10 years (adult), and ≥ 10 years (old). About 11 (26.8%) of the young cattle, 112 (46.7%) of the adult cattle, and 49 (47.6%) of the elderly cattle tested positive for foreign bodies among the groups under examination. The prevalence of foreign bodies varied significantly between the three age groups ($\chi^2 = 6.01$; $p = 0.05$) and exhibited an increasing trend from younger to older age groups. This result is in line with reports by Desalegn *et al.* (2018) and Amin and Fantehun (2020),

which showed that 80% of foreign bodies were discovered in the fore-stomach of older cattle, most likely as a result of the buildup of indigestible materials over time.

Of the animals that were slaughtered, 145 (52.5%) came from the midland and 27 (25%) from the highland. According to Table 2, the results showed a highly significant difference in the cattle's origin ($\chi^2 = 23.8$; $p = 0.00$). This discrepancy could be explained by differences in the individual regions' waste management and animal management systems.

Table 2. The prevalence of foreign bodies in relation to age and origin

Risk factors	Variable	No. of animals examined	Animals with foreign bodies	Prevalence	χ^2	p-value
Age	≤ 5 years	41	11	26.8	6.01	0.05
	5–10 years	240	112	46.7		
	≥ 10 years	103	49	47.6		
	Total	384	172	44.79		
Origin	Midland	276	145	52.5	23.8	0.00
	Highland	108	27	25		
	Total	384	172	44.79		

3.4 Predominance of Foreign Body based on Body Condition Score

According to the study, foreign bodies were found in 41% of cattle in good body condition, 46% of cattle in medium body condition, and 55.2% of cattle in poor body condition. Table 3 demonstrates that the variance between the various bodily conditions was statistically significant ($\chi^2 = 7.95$; $p = 0.02$). This result is consistent with a study by Desiye and Mersha (2012) that found that animals in poor condition had

a greater prevalence of foreign bodies (72.72%) than animals in medium condition (35.95%) and good condition (7.33%). Because foreign materials interfere with the absorption of volatile fatty acids (VFA), they may cause animals to be in poor physical condition and gain less weight (Ismael *et al.*, 2007; Rahel, 2011).

Table 3. Prevalence of foreign bodies in cattle based on body condition

Risk factor	Variable	Examined animal	Positive	Prevalence	χ^2	P-value
Body condition	Good	200	82	41	7.95	0.02
	Medium	126	58	46		
	Poor	58	32	55.2		
	Total	384	172	44.79		

3.5 Prevalence of Foreign Bodies within the organ

The study identified 44 (25.58%) foreign bodies in the reticulum, 117 (68.02%) in the rumen, and 11 (6.4%) in both the reticulum and the rumen. As seen in Table 4, the results demonstrated a highly significant difference across the stomach compartments ($p = 0.000$). In line with earlier research by Tesfaye and Chan (2012), who reported 67.3% in the rumen and 32.7% in the reticulum, the results showed that foreign bodies were more common in the rumen than in the reticulum. This disparity could be explained by the rumen's bigger volume, which can hold a wider range and amount of foreign substances. On the other hand, the reticulum tends to concentrate more on metals and sharp items (Kalu *et al.*, 2018).

Table 4. Frequency of rumen and reticulum foreign body slaughtered cattle in related to organ

Type of Foreign body	Location site of foreign body %			Total (N=172)
	Rumen (n=117)	Reticulum (n=44)	Rumen & Reticulum (n=11)	
Plastic	27(23.10)	8(18.60)	1(9.10)	37(21.50)
Nylon cloth materials	28(23.90)	8(18.60)	0(0.00)	36(20.93)
Rope materials	23(19.70)	1(2.30)	0(0.00)	24(13.95)
Leather materials	4(3.40)	4(9.30)	4(36.40)	12(6.97)
Iron /wire	6(51.13)	14(32.60)	0(0.00)	20(11.63)
Hair	8(6.80)	7(16.30)	0(0.00)	15(8.72)
Sack	13(11.10)	2(4.70)	0(0.00)	15(8.72)
Plastic +cloth	8(6.80)	0(0.00)	0(0.00)	8(4.65)
Plastic +wire + nail	0(0.00)	0(0.00)	6(54.50)	6(3.48)
Total	117(68.02)	44(25.58)	11(6.4)	172(100)
		$\chi^2 = 7.13$	P-value= 0.00	

4 Conclusion and Recommendations

The study's conclusions highlight the urgent problem of inedible foreign items in cattle killed at Southern Ethiopia's Dilla Municipal Abattoir. The health and welfare of cattle are seriously endangered when foreign items are improperly disposed of in grazing areas. The study highlights that cattle consuming foreign objects experience increased mortality rates and diminished productivity, exacerbating the challenges faced by livestock management in developing nations like Ethiopia.

A notable prevalence of such foreign materials was

observed in the rumen and reticulum of affected cattle, particularly among those in poor body condition and older age groups. As Ethiopia moves toward greater industrialization and mechanization, it is imperative for the government to collaborate with veterinary professionals to raise awareness about the challenges and potential strategies related to the presence of foreign objects in cattle diets.

Based on these conclusions, we recommend that the government implement policies to mitigate environmental pollution and promote bioremediation to lower the risk of foreign body ingestion in livestock. Additionally, educational programs for farmers and

the public should emphasize the hazards posed by foreign objects in cattle diets and the importance of proper waste disposal. A robust monitoring system is needed to regularly evaluate cattle health and detect foreign objects in slaughtered animals. Implementing effective diagnostic methods for the timely identification of at-risk cattle will facilitate prompt treatment for affected animals.

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