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

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Abstract

The research was conducted on cattle slaughtered at the Dilla Municipal Abattoir in the Gedeo Zone of Southern Ethiopia from March to July 2024. The study aimed to evaluate the prevalence and associated risk factors of indigestible waste objects in slaughtered cattle. A cross-sectional study design was employed to assess the animals through both ante-mortem inspections and post-mortem examinations. During these examinations, various foreign bodies were identified in the rumen and reticulum. Out of 384 slaughtered cattle, 172 (44.79%) tested positive for the presence of 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%). Plastic materials were primarily located in the rumen, while non-plastic objects were mainly found in the reticulum. Rumen foreign bodies had a higher prevalence than those found 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 materials 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.

Thus, this study focuses on the prevalence and location of indigestible foreign bodies in the forestomach (rumen and reticulum) to address the health and digestive challenges faced by cattle. Additionally, identifying associated risk factors will aid in developing management protocols, preventive strategies, and policies for addressing foreign body ingestion in animal health and mitigating environmental pollution. The objectives of this study are to assess the prevalence and distribution of indigestible foreign bodies and to identify related risk factors in cattle butchered at the Dilla Municipal Abattoir.

2 Materials and Methods

2.1 Study Area

The study was conducted at the Dilla Municipal Abattoir, located 365 km from Addis Ababa in Southern Ethiopia. Dilla is situated at a latitude of 6^o24'30"N and a longitude of 38^o18'30"E, with an average elevation of 1,570 meters above sea level. The town is approximately 90 km from Hawassa. The Gedeo Zone is characterized by a warm and humid climate, with a mean annual temperature ranging between 17^oC and 22.4^oC, and mean annual rainfall between 1,200 and 1,800 mm.

The population of Dilla is estimated to be 102,624, comprising 50,286 males and 52,338 females. The Gedeo Zone has an assessed livestock population of 133,925 cattle, 197,846 sheep, and 22,621 goats (CSA, 2021).

2.2 Study Population

The study was conducted on 384 apparently healthy butchered cattle of both sexes at the Dilla Municipal Abattoir from March to July 2024. The slaughtered cattle originated from two agro-ecological zones (midland and lowland) and were kept under various management systems. The animals were categorized based on age, sex, body condition, and breed to assess the occurrence of ingested inedible solid waste materials.

2.3 Study Design

A cross-sectional study was conducted at the Dilla Municipal Abattoir from March to July 2024 to examine the presence of solid waste materials in the rumen and reticulum of butchered cattle. The study considered breed, age, body condition, sex, and origin of the cattle as potential risk factors. Age groups were classified as young, adult, and old based on dentition (Johnson *et al*., 1997). Body condition was assessed through visual inspection and palpation of the lumbar vertebrae (Rabana *et al*., 2022).

2.4 Sampling Technique and Sample Size Determination

The sample size was determined using the equation given by Thrusfield (2005). The test estimate was decided based on an anticipated predominance of 50% and a desired precision of 5% at a 95% confidence interval. The sample size was calculated utilizing the following formula:

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

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

Ante-mortem examinations were conducted to assess the age, sex, breed, and body condition of the cattle. Age was categorized as young (<5 years), adult (5-10 years), and old (>10 years). Body condition was recorded as poor, medium, or good based on the animal's appearance and manual palpation of the spinal processes and transverse processes of the lumbar vertebrae, as described by Nicholson and Butterworth (1986) and Mangun *et al*. (2024). 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 solid waste found were recorded.

2.6 Data Analysis

The data collected was entered into a Microsoft Excel worksheet and analyzed using the Statistical Package for Social Sciences (SPSS, Version 20). Descriptive statistics, such as means and percentages, were used to summarize the results. The prevalence of foreign bodies in the rumen and reticulum was calculated as a percentage by dividing the total number of cattle positives for ingested foreign bodies by the total number of cattle inspected. The Pearson chi-square (χ^2) test was employed to examine the association between the prevalence of foreign bodies and potential risk factors. Significant differences were considered at $P \leq 0.05$.

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 Chanie, 2012). Among the 172 positive cases identified, approximately 68.2% of foreign bodies were located in the rumen, while 25.58% were found in the reticulum, and 6.4% were present in both organs. This suggests a significant presence of foreign bodies in the rumen, although lower than the 70.2% prevalence reported by Bitew (2025). The higher prevalence of foreign bodies in the rumen in previous studies may be explained by the fact that a substantial portion of ingested feed is directed to this organ, which, being the primary digestive compartment, increases the likelihood of foreign body accumulation.

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. Additionally, the high proportion of plastic foreign bodies may be exacerbated by the lack of recycling industries in the study area, contributing to the prevalence of plastic-related incidents in the rumen. The anatomical structure of the rumen also facilitates the retention of various ingested foreign bodies, particularly plastic materials (Tesfaye and Chanie, 2012).

Figure 1. Disclosed organs from rumen, reticulum and both

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

The butchered cattle were categorized into three age groups: ≤5 years (young), 5-10 years (adult), and ≥10 years (old). Among the examined groups, approximately 11 (26.8%) of the young, 112 (46.7%) of the adult, and 49 (47.6%) of the old cattle tested positive for foreign bodies. The occurrence of foreign bodies among the three age groups showed significant variation (χ^2 = 6.01; p = 0.05) and revealed an increasing trend from younger to older age categories. This finding is consistent with reports by Amin and Fantehun (2020) and Desalegn *et al*. (2018), which indicated that 80% of foreign bodies were found in the fore-stomach of older cattle, likely due to the accumulation of indigestible materials over time.

Based on the origin of the slaughtered animals, 145 (52.5%) were from the midland and 27 (25%) were from the highland. The results indicated a highly significant difference in the origin of the cattle (χ^2 = 23.8; p = 0.00), as shown in Table 2. This distinction may be attributed to variations in animal management systems and waste management practices in the respective areas.

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	≤5years	41	11	26.8	6.01	0.05
	5-10years	240	112	46.7		
	≥10years	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

The study indicated that the prevalence of foreign bodies was 41% in cattle with good body condition, 46% in those with medium body condition, and 55.2% in those with poor body condition. The variance among the different body conditions was statistically significant (χ^2 = 7.95; p = 0.02), as shown in Table 3. This finding aligns with the study by Desiye and Mersha (2012), which reported a higher prevalence of foreign bodies in poorly conditioned animals (72.72%) compared to those with medium (35.95%) and good (7.33%) body condition. The presence of foreign bodies may contribute to poor body condition in animals, leading to reduced weight gain due to interference with the absorption of volatile fatty acids (VFA) (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 117 foreign bodies (68.02%) in the rumen, 44 (25.58%) in the reticulum, and 11 (6.4%) in both the rumen and reticulum. The results showed a highly significant difference among the stomach compartments (p = 0.000), as indicated in Table 4. The findings revealed a higher occurrence of foreign bodies in the rumen compared to the reticulum, which is consistent with previous research by Tesfaye and Chanie (2012), who reported 67.3% in the rumen and 32.7% in the reticulum. This discrepancy may be attributed to the larger volume of the rumen, which accommodates a greater variety and quantity of foreign materials. In contrast, metals and sharp objects tend to concentrate more in the reticulum (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)
		χ^2 =7.13	P-value= 0.00	

4 Conclusion and Recommendations

The findings of this study underscore the pressing issue of inedible foreign objects in cattle slaughtered at the Dilla Municipal Abattoir in Southern Ethiopia. Inappropriate disposal of foreign materials in grazing areas poses significant risks to the health and well-being of cattle. 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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