

Postmortem Study on Indigestible Foreign Bodies in Rumen and Reticulum of Ruminants Slaughtered at Asella Municipal Abattoir, Southeastern Ethiopia

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Abstract

Background: Ingestion of indigestible foreign bodies by ruminants is becoming a common worldwide problem which is the associated with a shortage of feed as well as increased pollution of grazing lands with indigestible materials.

Methods: Cross-sectional study was conducted from November 2016 to January 2017 on 500 ruminants slaughtered at Asella municipal abattoir with the objective to determine the prevalence and type of indigestible foreign body in rumen and reticulum of ruminants in association with hypothetical risk factors. Simple random sampling technique was used for selecting the study animals which were ruminants brought from various localities to Asella municipal abattoir. Logistic regression was used to determine the association of risk factors with occurrence of foreign body.

Results: Out of 500 ruminant examined (sheep 240, goats 60 and cattle 200) examined for the presence of indigestible foreign bodies, 109 (21.8%) animals were found positive for one or more indigestible foreign bodies in their rumen or reticulum. The prevalence of foreign bodies was significantly ($p=0.000$) higher in sheep (29.6%) (OR=2.581, CI=1.587, 4.196) and goat (16.7%) (OR=1.229, CI=0.559, 2.701) than cattle (14%). Multivariable logistic regression analysis revealed that the risk of foreign body ingestion was insignificantly higher in sheep than goats (OR=2.074, CI, 0.958, 4.486; $p=0.064$), in female shooat than male (OR=1.137, CI=0.558, 2.317, $p=0.723$). Significantly highest prevalence was observed in shooat greater than 3 years than shooat less than 2 years (OR=2.564, CI=1.160, 5.670, $p=0.031$), in thin body conditioned small ruminants than good body conditioned (OR=3.361, CI=1.554, 9.100, $p=0.002$), in cattle above 7 years than cattle below 4 years (OR=7.57, CI=2.018, 28.445, $p=0.000$), in thin body conditioned cattle than good body conditioned (OR=10.347, CI=1.769, 60.520, $p=0.013$). Plastic was the most commonly encountered (56.9%) foreign material in all study animals, followed by cloth (13.8%), rope and mixed (9.2%), wire (6.4%) and nail (5.5%). In all species the proportion of indigestible foreign body in rumen (77.1%) were significantly higher than reticulum (22.9%) (OR=3.8365, CI=2.4086, 6.1111, $p=0.001$).

Conclusion: This study revealed ingestion of different types of indigestible foreign bodies by ruminants in the study area which may pose serious health problem for free grazing ruminant and negatively affect their overall productivity and production. This strongly calls for concerned stakeholders to design and implement appropriate waste disposal practice and thereby reduces the chance of ingesting foreign bodies.

Keywords: Asella municipal abattoir; Indigestible foreign bodies; Postmortem study; Ruminants

Introduction

Ethiopia is resource full country endowed with larges population of livestock in Africa. The total cattle populations of the country is estimated to be about 57.83 million, whereas the number of small ruminants are estimated to exceed 58 million [1]. However, development this sector is hampered by different constraints and has not been fully exploited the benefit of indigenous livestock compared to its tremendous potential. significant losses result each year from the death of animals as a result of lack of appropriate veterinary services, lack of attention from government, wide spread endemic disease and recurrent drought [2]. Ingestible foreign body predisposed by environmental pollution is currently becoming a global health problem of ruminants and have been implicated as among common causes of sudden death [3,4].

Different studies have shown that ruminants reared in urban and sub-urban areas have high probability to ingest indigestible materials such as plastic, cloth, wire, leather and metal [5,6]. Ingestion of indigestible foreign bodies by animals is mainly associated with nutritional deficiencies, environmental pollution and poor feeding management

[7]. According to different studies the common non-piercing foreign bodies commonly ingested by ruminants are plastic bags, sack thread, ropes, leather, rubber, bed linen, pieces of lead pipe, straw baskets, hair and plant fibers (bezoars) [4]. While wire, needles, nails and stones are the major penetrating foreign bodies isolated from ruminants [8,9]. In cattle, ingestion of foreign body was reported to be a condition of great economic importance as it causes loss of production and high mortality rates [10]. However, ingestion of indigestible foreign body can occur in small ruminant during periods of drought, food scarcity, nutritional

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deficiency, pica and massive environmental pollution [11,12].

Foreign body exposes ruminants to various forms of diseases such as glossitis, esophagitis, ruminitis, impaction of rumen, traumatic pericarditis (TP) and traumatic reticulo peritonitis (TRP) are the possible health problems, which can be caused by the ingestion of foreign bodies by the ruminants [3]. Other harmful effects of foreign body include reduced feed intake, failure to absorb volatile fatty acids, reduced rate of weight gain, internal injury, and death following obstruction of the intestinal tract [3,11]. Nonmetallic indigestible foreign bodies in the reticulorumen cause recurrent rumen tympany in adult dairy cattle. Although the problems caused vary with the duration and location of the foreign body in the rumen or reticulum, the degree of obstruction in appetite, vomiting, diarrhea, lethargy and abdominal pains are clinical signs manifested by animals with foreign body [13].

In Ethiopia, ruminants are kept under poor extensive farming system and they are more likely to be exposed to ingestion of indigestible materials from different sources due to high environmental contamination with plastic bags and other materials. Despite the free grazing of ruminants in contaminated environments, there is limited information about prevalence and type of foreign bodies ingested by ruminants at national level in general and in Asella in particular. Therefore, the objectives of this study were to estimate the prevalence of foreign bodies in the rumen and reticulum of ruminants and identify the types of foreign bodies and risk factors associated with ingestion of indigestible foreign bodies in ruminant slaughtered at Asella municipal abattoir.

Materials and Methods

Study area

Asella is a capital of Arsi Zone, Oromia regional state. It is located about 175 km south east of Addis Ababa at 6° 59' to 8° 49' N latitudes and 38° 41' to 40° 44' E longitudes. The town and its surrounding is characterized by mid subtropical weather, with minimum and maximum temperature ranging from 8.4 to 22.6°C, and the relative humidity ranging from 43 to 60%. The area is characterized by two-phase rainfall occurring from March to April (short rainy season) and July to October (long rainy season) with average annual rainfall of 2000 mm. The farmers in the area practice mixed crop-livestock farming system. According to Arsi Planning and Development Office (2007), the area is densely populated, with livestock population of 85,893 cattle, 57,118 sheep, 10,725 goats, 7841 horses, 15,642 donkeys, 517 mules and 35,489 poultry.

Study population and study design

A cross-sectional study was conducted from November, 2016 to January, 2017 in Asella municipal abattoir with the objective of estimating the prevalence of foreign bodies and to identify the type of foreign bodies in the study population. Animals included in this study were cattle, sheep, and goats with different body condition. The study animals are comprised of local breed with different age groups and most of them are managed under extensive management system. Regarding sex composition of study animals both males and females' small ruminants were included. However, only male cattle were included in this study as female cattle were not encountered in Asella municipal abattoir during study period. The cattle and sheep are originated from Sagure, Bekoji, and Asasa and most goats were brought from Habura.

Sample size determination and sampling technique

The sample size was determined based on the formula given by Thrusfield with 50% expected prevalence (no previous study in the study area), 5% desired level of precision and 95% of confidence interval. Accordingly the required samples for this study were 384 animals. However, to increase the precision 500 animals were examined. The data for this study was collected by visiting abattoir twice a week and the daily cattle and small ruminant slaughter at Asella municipal abattoir was 23–30 and 17–30, respectively. The study animals were selected from cattle, sheep and goats slaughtered during each visit day by using simple random sampling technique.

Ante mortem and post mortem examination

During ante mortem examination each selected animal was identified by providing a unique temporary identification number that could be used for post mortem examinations. Furthermore, the animals' species, sex, age and body conditions were recorded on special format prepared for this purpose. Age and body condition of the animals was determined based on standard given by Gatenby, Pace, Wakeman and Steele. The body condition of study animals were classified in to three, namely thin, medium, and good. Similarly, the age was also classified in to three which comprise <2, 2-3, >3 for small ruminants and <4, 4-7, and >7 for cattle. During postmortem examination, the stomach was removed from the abdominal cavity and rumen and reticulum were examined by visual inspection and palpation which were followed by incision and examination of the whole contents for the presence of foreign bodies. When foreign bodies are encountered, they were removed, washed, and identified and photographed while possible.

Data management and analysis

The data were first entered in to Microsoft Excel work sheet version 2010 and analyzed using Statistical Package for Social Sciences (SPSS) software version 20. Descriptive statistics was used to determine frequencies, percent and over all prevalence. The prevalence of indigestible foreign bodies was determined as a proportion of affected animals out of the total animal examined. Multivariate logistic regression analysis was used to calculate association between different factors and occurrence of indigestible foreign body in ruminants. A 95% confidence interval of the OR and p-values were used to describe statistical significance associations. The association is judged as significant when p-value is less than 0.05.

Results

Prevalence of foreign body in relation to animal species

From 500 ruminants (240 sheep, 60 goats and 200 cattle) examined for the presence of indigestible foreign bodies, 109 (21.8%) animals were found positive for one or more indigestible foreign bodies in their rumen or reticulum. When sheep, goats and cattle There was significant difference ($p=0.000$) between species with higher prevalence in sheep (29.6% and followed by goat (16.7%) and cattle (14%). The results indicate that sheep and goat were 2.581 and 1.229 times more likelihood to acquire foreign body than cattle, respectively. The detailed results for each species are shown in Table 1.

Types and proportions of indigestible foreign bodies in the rumen and reticulum

From indigestible foreign body encountered plastics were leading indigestible material (56.9%) (Figures 1-3), followed by pieces of cloth (13.8%), rope and mixed (plastic, rope and hair) (9.2%), wire (6.4%) and nail (5.5%). In all species (ovine, caprine and bovine), the proportion of

indigestible foreign body in rumen (77.1%) were significantly higher than reticulum (22.9%). The odd of foreign body occurrence in rumen was 3.8365 times more likely than reticulum (OR=3.8365, CI=2.4086, 6.1111, $p=0.001$). The types of foreign bodies encountered and their proportion in rumen and reticulum of various species of ruminants are summarized in Table 2.

Factors associated with indigestible foreign bodies ingestion

Factors associated with indigestible foreign bodies ingestion in small ruminant: Out of 300 small ruminants (sheep 240 (80%),

Animal species	Number of examined	Prevalence	OR	95%CI	P- Values
Sheep	240	71(29.6%)	2.581	1.587, 4.196	0.000
Goat	60	10(16.7)	1.229	0.559, 2.701	
Cattle	200	28(14%)	Ref.		

Table 1: Prevalence of foreign bodies in sheep, goats and cattle.



Figure 1: Plastic foreign body removed from bovine rumen.



Figure 2: Mixed (Plastic and rope) recovered from rumen of goat.



Figure 3: Calcified plastic from bovine reticulum.

and goats 60 (20%) examined 81 animals were found to be positive for indigestible foreign bodies. Multivariable logistic regression analysis showed that the prevalence of indigestible foreign body were insignificantly higher ($p=0.064$) in sheep (29.5%) than goats (16.6%) and sheep were 2.074 times more likely to ingest foreign body than goats (OR=2.074, CI, 0.958, 4.486). The prevalence in relation sex was also found to be insignificantly higher in female (27.9%) than male (23.9%). Females were found to be 1.137 times more susceptible than males (OR=1.137, CI=0.558, 2.317, $p=0.723$). Impaction due to foreign body occurred in small ruminant <2 years, 2-3 years and >3 years were, 16.6%, 23.3% and 33.3%, respectively. This difference was found to be statically significant ($p=0.031$). Shoat >3 and 2-3 years were 2.564 and 1.459 time more likely to ingest foreign body than small ruminant under 2 years. The highest prevalence was observed in shoat greater than 3 years (OR=2.564, CI=1.160, 5.670) and between 2 to 3 years (OR=1.459, CI=0.601, 3.541) than shoat less than 2 years.

Regarding the prevalence of indigestible foreign bodies in different body conditioned small ruminant, the highest occurrence of foreign body were recorded in animal with thin body condition score (42.2%) followed by medium (23.7%) and good body condition animals (17.3%). There was statically significance deference between deferent body conditioned shoat ($p=0.002$). Small ruminants with thin body conditioned were 3.361 time more likely to ingest indigestible foreign body than good body conditioned (OR=3.361, C%I=1.554, 9.100). Similarly the odd of indigestible foreign body occurrence in medium body conditioned shoat was 1.378 times more likely than good body conditioned shoat. The numbers of animals examined in the various body condition categories and their corresponding prevalence are summarized in Table 3.

Prevalence of foreign body in relation to age and body condition of cattle: The prevalence in relation to age of cattle was 9.7%, 9.4% and 37.5% in cattle under 4 years, 4-7 years and above 7 years and this difference was statically significant ($p=0.000$). Multivariable logistic regression analysis indicated that cattle above 7 years are 7.57 times more likely to ingest indigestible foreign body than cattle under 4 years (OR=7.57, CI=2.018, 28.445). Similarly the odds of foreign body occurrence in cattle between 4-7 years were 0.976 more likely than cattle under 4 years (OR=0.976, CI=0.289, 3.300) (Table 4). The prevalence of foreign body in relation to body condition of cattle were also significantly different ($p=0.013$). The cattle with thin body conditioned are 10.347 more likely to ingest indigestible foreign bodies than good body conditioned cattle (OR=10.347, CI=1.769, 60.520). The odds of foreign body occurrence in medium body conditioned cattle were 4.198 more than good body conditioned cattle (OR=4.198, CI=1.384, 12.735).

Discussion

The current study showed an overall foreign body prevalence of 21.8% (109/500) in ruminants slaughtered at Asella municipal abattoirs. This study revealed relatively higher foreign body prevalence (27%) in small ruminants (sheep (71/240 29.6%), and goats (10/60, 16.7%) than cattle 28/200(14%). This finding in line with Negash et al. who reported higher prevalence in small ruminants (58.2%) than cattle (43.4%) [7]. This may be due to the fact that most of cattle slaughtered in this abattoir had good body condition, which is indicate that cattle were reared with sufficient feed by owner. In contrast, most of small ruminant owners in this study area let their animal to forage on the highly polluted ground with no supplementary feed (Figure 4). If owners do not provide supplementary feed during feed shortages,

Location	Ruminant species	Frequency and Type of foreign bodies							Association				
		Plastic	Cloth	wire	Rope	Nail	Mixed	Subtotal Total	Overall	Prevalence	OR	95% CI OR	P-Values
Rumen	Sheep	35(49.3%)	8(11.3%)	0	4(5.6%)	2(2.8%)	9(12.7%)	58(81.7%)	84 (77.0%)	16.8%	3.8365	2.4086, 6.1111	0.0001
	Goat	4(40%)	2(20%)	0	2(20%)	0	1(10%)	9(90%)					
	Cattle	10(35.7%)	4(14.3%)	0	2(7.1%)	1(3.5%)	0	17(60.7%)					
Reticulum	Sheep	7(9.9%)	0	5(7%)	1(1.4%)	0	0	13(18.3%)	25(22.9%)	5%	3.8365	2.4086, 6.1111	0.0001
	Goat	1(10%)	0	0	0	0	0	1(10%)					
	Cattle	5(17.9%)	1(3.6%)	2(7.1%)	1(3.6%)	3(10.7%)	0	11(39.3%)					
Total		56.9%	13.8%	6.4%	9.2%	5.5%	9.2%	100%	100%	21.8%			

Table 2: Types and proportions of indigestible foreign bodies in the rumen and reticulum of ruminant species.

Risk Factors		Number Examined	Frequency and prevalence of different indigestible foreign bodies						Prevalence (%)	OR	95% CI of OR	P-Values
			Plastic n (%)	Cloth n (%)	Wire n (%)	Rope n (%)	Nail n (%)	Mixed n (%)				
Species	Sheep	240	42(17.5)	8(3.3)	5(2.1)	5(2.1)	2(0.8)	9(3.8)	71 (29.5)	2.074	0.958, 4.486	0.064
	Goat	60	5(8.3)	2(3.3)	0	2(3.3)	0	1(1.7)	10 (16.6)			
Sex	Male	67	7(10.4)	2(3)	1(1.5)	4(6)	0	2(3)	16 (23.9)	1.137	0.558, 2.317	0.723
	Female	233	40(17.2)	8(3.4)	4(1.7)	3(1.3)	2(0.9)	8(3.4)	65(27.9)			
Age	<2 years	60	7(11.7)	1(1.7)	0	0	1(1.7)	1(1.7)	10 (16.6)	Ref.		0.031
	2-3	90	11(12.2)	4(4.4)	1(1.1)	2(2.2)	0	3(3.3)	21(23.3)			
	>3 years	150	29(19.3)	5(3.3)	4(2.7)	5(3.3)	1(0.7)	6(4)	50(33.3)			
BCS	Thin	71	16(22.5)	3(4.2)	2(2.8)	3(4.2)	0	5(7)	30 (42.2)	3.361	1.554,9.100	0.002
	Medium	177	29(16.4)	5(2.8)	0	2(1.1)	2(1.1)	4(2.2)	42 (23.7)			
	Good	52	2 (3.8)	2 (3.8)	2(3.8)	1(1.9)	0	1(1.9)	9 (17.3)			
Total		300	47 (15.6)	10(3.33)	4(1.33)	6(2)	1(0.33)	10(3.33)				

Table 3: Multivariable logistic regression analysis output of factors associated with indigestible foreign body occurrence in small ruminant.

Risk Factors		No. Examined	Plastic (%)	Cloth (%)	Wire (%)	Rope (%)	Nail (%)	Prevalence (%)	OR	95%CI	P- Values
Age	<4 years	41	1(2.4)	2(4.9)	0	1(2.4)	0	4 (9.7)	Ref.		0.000
	4-7	127	7(5.5)	1(0.8)	2(1.6%)	1(0.8)	1(0.8)	12 (9.4)	0.976	0.289, 3.300	
	7 years	32	7(21.9)	2(6.3)	0	1(3.1)	3(9.4)	12(37.5)	7.577	2.018, 28.445	
Body condition	Thin	10	1(10)	2(20)	0	0	0	3 (30)	10.347	1.769, 60.520	0.013
	Medium	113	11(9.7)	3(2.7)	2(1.8%)	2(1.8)	2(1.8)	20 (17.6)	4.198	1.384, 12.735	
	Good	77	3(3.9%)	0	0	1(1.3%)	2(2.6%)	5 (6.5)	Ref.		

Table 4: Multivariable logistic regression analysis output of factors associated with indigestible foreign body occurrence in cattle.

their animals are likely to face a negative energy balance that will force them to ingest unusual materials including plastic, cloth, rope and even metallic objects Furthermore, most all bovine slaughtered in Asella municipal abattoir were male and this may also be associated lower prevalence in cattle.

Small ruminant overall prevalence (27%) approximate o the findings of Fasil et al. who reported 30.73% in Jigjiga municipal abattoir [14]. However, this finding is higher than study by Roman and Hiwot (23.4%), Igbokwe et al. (19.3%), Bwala et al. (16.5%), Otsyina et al. (10.8%), Tesfaye et al. (6.1%), Abebe and Nuru (9.2%) [11,12,15-18]. This difference in the prevalence of foreign bodies between different areas may be associated with differences in animals' management system, age of animal slaughtered, sex and the extent of foreign body management between different study areas.

In the present study, the occurrence of foreign bodies was insignificantly higher (P=0.064) in sheep than goats during multi variable logistic regression analysis which is accordance with the report of Sheferaw et al. [19]. This variation could be associated with the selective feeding nature of goats as they usually browse on bushes and shrubs thus putting them at a relatively lower risk of ingesting foreign

materials from the ground and origin of animal may also contribute for lower prevalence. Since most sheep slaughtered at Asella municipal abattoir were brought from per urban area, they were relatively at risk to graze on contaminated grazing area.

Although it is not significant, higher prevalence of foreign body was also observed in females (27.9%) than males (23.9%). This is in contrast with the reports of Remi-Adewunmi et al. [6]. However, higher prevalence of indigestible foreign bodies in female sheep and goats have also been reported by other authors [11,12,15,18,20]. This may be due to increased appetite of female animals and high nutritional demands during gestational period.

According to this study shoat with age greater than 3 years are frequently affected with indigestible materials than the shoat aged less than 2 years and 2-3 groups. The current finding was different from report of Otsyina HR et al. who encountered plastic bags most frequently in sheep and goats in the 2-3 years old age group (37.5%) followed by those in the 1-2 year old age group (24.1%) and absence of foreign material in animals older than 4 years [13]. However, this finding is in agreement with Hailat et al., Igbokwe et al., Remi-Adewunmi et al., Roman and Hiwot, Abebe and Nuru, Saulawa et al.



Figure 4: Photo taken from animals grazing in contaminated area in Asella town.

Tesfaye et al. [11,15,18,20-23]. This may happen because of ingestion of indigestible substances over a prolonged period.

Overall the prevalence of foreign bodies in small ruminant with poor body condition of (45.8%) was significantly higher ($p=0.002$) than in those with medium (23.2%) and good body condition (15.4%). This finding is in agreement with the reports of Hailat et al., Igbokwe et al., Remi-Adewunmi et al., Roman and Hiwot, Abebe and Nuru, Saulawa et al., Tesfaye et al. [6,11,15,18,21-23]. This may be because of thin body condition animals consuming without selection to compensate there energy balance. As a result poor body condition of animals with indigestible foreign bodies was attributed to reduction in volatile fatty acids absorption from rumen and this result in inappetence, abdominal distention, reduced weight gain, lack of defecation with consequent emaciation and recumbence [11].

The prevalence of foreign bodies observed in cattle (14%) was in approximate agreement with the report of Tesfaye et al. 13.22%, Akinbobola (12%), Mushonga et al. (17.4%) and Bassa and Tesfaye (17.16%) [17,24,25].

However, this finding is lower when compared to Negash et al. (43.4%), Sheferaw et al. (41.8%) and Anwar et al. (59.14%) [7,4,19]. This is may be due to sex factor, breed, and management difference. Prevalence of foreign bodies in cattle with poor body condition was 30% which is significantly higher ($p=0.013$) than in those with medium (17.6%) and good body condition (7.8%). This finding is in agreement with the reports of Hailat et al. and Negash et al. [7,22].

Accumulations of indigestible foreign bodies were significantly higher in rumen ($p=0.001$) of all study animal than in the reticulum. This finding was in agreement with the findings of Abebe and Nuru, Roman and Hiwot, Tesfaye et al. and Negash et al. [7,15,17,18]. This may be because of the larger rumen volume, the cumulative size/s and material composition of the foreign bodies, and the types of materials, with metals and sharp objects tending to localized preferentially in reticulum [3]. Plastic was the most commonly encountered (56.9%) foreign material in all study animals, followed by cloth (13.8%), rope and mix (9.2%), wire (6.4%) and nail (5.5%). This finding is in general agreement with various reports from different areas of Ethiopia (Abebe and Nuru, Roman and Hiwot, Sheferaw et al., Tesfaye et al.) [15,17-19], Nigeria (Igbokwe et al., Remi- Adewunmi et al.) [6,11] and Jordan (Hailat et al.) [22]. This indicates the widespread use of plastic bags

in these areas and environmental pollution due to their improper disposal.

Conclusively this study indicated 21.8% prevalence of indigestible foreign body in rumen and reticulum of ruminants in study area which is an indication of poor environmental protection and pollution with plastics and other indigestible foreign bodies. Thus, order to avert the problem emergency designing and implementation of appropriate waste disposal practice is urgently required to reduce environmental pollution thereby enhances livestock production and productivity. Furthermore, Creation of awareness for animal owners is necessary to avoid the risk of foreign body ingestion by their animals.

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Conflict of Interest

Authors declare no conflict of interest.

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