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Research Article

Prevalence of rumen and reticulum indigestible foreign body in goat at Haramaya municipal Abattoir, Ethiopia

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Abstract

A cross sectional study was conducted on goat slaughtered at Haramaya municipal abattoir from February - August 2021 to determine the prevalence of foreign bodies in rumen and reticulum of goat and to assess the association of risk factors with the occurrence of foreign bodies. Postmortem examination was conducted for the recovery of foreign body from rumen and reticulum. A total of 384 goat were selected using simple random sampling method and of which 193 (50.26%) of them were found positive for indigestible foreign bodies in their rumen and reticulum. Risk factors such as age, body condition score and sex were taken into consideration. There was statistical significance difference between prevalence recorded in adult (49.34%) and old (54.97%, p=0.02). Statistical significant difference were recorded in poor (61.63%) and good body conditioned goat (43.36%, p=0.039). However, no statistical significance difference (P > 0.05) was observed in sex recorded for female (52.19%) and male (12%, p=0.79). The prevalence of plastics foreign body (46.88%) is higher followed by cloth (0.8%), rope (0.8%), wire (0.26), plastic and cloth (0.8) and plastic and rope (0.8). The prevalence of foreign body ingestion found in goat by this study show that the grazing areas were contaminated with plastic material, clothes, ropes, wire and other indigestible materials could pose serious health problem for free grazing animals. Awareness should be created on careless disposal of indigestible materials and the periodical cleaning of these wastes in the grazing area should be established in the study area.

Keywords: Abattoir; Foreign body; Goat; Rumen; Reticulum

Introduction

Livestock Production constitutes one of the principal means of achieving improved living of standards in many regions of the developing world. In sub-Saharan African countries, Livestock plays a crucial role both in national economies and livelihood of rural communities. It provides drought power, milk and meat input for crop production and soil fertility and raw material for industry (Sissay *et al*., 2007).

Ethiopia has the largest livestock population in Africa. An estimate indicates that the country is a home for about 57.8 million cattle, 28.89 million sheep and 29.7 million goats (CSA, 2016). Despite the large animal population, productivity in Ethiopia is low and even below the average for most countries in eastern and sub-Saharan African countries, due to poor nutrition, reproduction insufficiency, management constraints and prevailing animal diseases (Bekele *et al*., 2010). Livestock production is an important integral component of the Ethiopian agricultural production system and plays an imperative role in the development of the country's economy and for the food and nutritional security. The subsector contributes about 16.5% of the national gross domestic product (GDP) and 35.6% of the agricultural GDP (Metaferia *et al*., 2011).

Foreign bodies are reported to be a common cause of surgical emergency in Veterinary Medicine and have been implicated as among common causes of sudden death (Radostitis *et al*., 2007; Anwar *et al*., 2013). Indigestible foreign bodies in the rumen and reticulum predisposed by environmental pollution are fast becoming a major global problem in ruminants worldwide (Kumar and Dhar, 2013). Furthermore, Industrialization and mechanization of agriculture have increased the incidence of foreign body ingestion (Semieka, 2010). When ingested by animals foreign bodies get lodged in the rumen thereby compromising ruminal space and interfering with normal physiological functions of the rumen leading to weight loss with or without an enlarged abdomen or death (Anwar *et al*., 2013; Kumar and Dhar, 2013; Bwala *et al*., 2016).

The foreign bodies, especially large plastic, influence the digestion process by occupying space and blocking ingesta movement, which ultimately impair the health and productivity of animals. Plastics and other materials that are not able to decompose have no only direct effect on the animals, but also can remain in the environment for a long time which ultimately affects the soil fertility and thus may reduce the quality and quantity of pasture in the environment (Sheferaw *et al*., 2014).

In cattle indigestible foreign bodies was reported to be condition of great economic importance and causes severe loss of production and high mortality rates (Radostitis *et al*., 2007). However, Ingestion of large quantities of indigestible materials occurs in small ruminant during periods of drought, food scarcity, nutritional deficiency, pica and massive environmental pollution (Igbo we *et al*., 2003; Ghurashi *et al*., 2009; Otsyina *et al*., 2015). This condition is common especially in developing countries where the standard of animal management is unsatisfactory (Fasil, 2016).

In Ethiopia, goats are preferably reared by rural low income farmers, attributed to their low cost of production,

adaptability to hot environment through their dynamic feeding behavior, high fertility and growth rates and fast reproduction cycle (Tsegaye*et al*., 2013). In Ethiopia, about 16.8% of total meat supply (Ameha, 2008) and 16.7% of milk consumed (Tsedeke, 2007) is contributed from goat production. Despite the large number of goats and their contributions to the livelihood of the farmers and the national economy, goat productivity in Ethiopia is low due to different factors including shortage, seasonal unavailability, low nutritive value of feed and/or poor nutrition (Tsegaye, 2009; Solomon *et al.*, 2010); prevalence of different diseases and parasites (Tsegaye, 2009; Solomon *et al*., 2010; Tsegaye *et al*., 2013). Feed shortage is more aggravated during the dry season in both the highlands and lowlands of Ethiopia (Alemayehu, 2006) and in most parts of the country crop residues and poor quality hay are characterized by low digestibility and intake, are the major feed resources of ruminants (Nurfeta, 2010).

In Ethiopia small ruminants are left to roam and seek their own feed as the raising system is mainly extensive type. The areas available for grazing particularly in the case for animals reared in the urban and sub-urban areas are polluted with plastics, ropes, cloth and metals. This pollution may be predicated as a growing problem for grazing animals because of the poor waste management system and inadequate availability of feed during the dry season (Fromsa and Mohammed, 2011; Fasil, 2016).

Several investigation were conducted on indigestible foreign bodies in cattle in Ethiopia (Dawit *et al*. 2012; Tesfaye and Chanie, 2012; Nugusu*et al*. 2013; Sheferaw *et al*., 2014; Negash *et al*., 2015). However, there are limited studies on goat despite free grazing system of animals in contaminated environments. Thus, there is scarcity of information on indigestible foreignbodies in goat. Therefore, the main objectives of this study were,

- To estimate the prevalence of foreign body in rumen and reticulum of goat slaughtered at Haramaya municipal abattoir.
- To assess the possible risk factors associated with the ingestion of different foreign bodies.

Materials and Methods

2.1. Description of study area

The study was conducted at Haramaya municipal abattoir. It is found in East Hararghe administrative zone of Oromia Regional in Eastern Ethiopia. The study area has latitude and longitude of 9°24′N 42°01′E and the area is found at an altitude of 1600-2100 m.a.s.l. with 64.5 relative humidity and 511Km far from Addis Ababa. The district experience rain fall with a short rainy season occurs usually in February and long rainy season extends from July to September. The annual rain fall of the areas ranges from 118-866 mm similarly the average monthly minimum and maximum temperature of the area is 9.4 and 24 ^{0}c, respectively.

2.2. Study population

The study was conducted on goat slaughtered in Haramaya Municipal Abattoir. 384 goats slaughtered in the abattoir came from the town itself and localities around the town. All goat slaughtered were local breed.

2.3. Study design

A cross sectional study was conducted to assess the prevalence of the rumen and reticulum foreign bodies to identify the types of origin bodies and their associated risk factors for the occurrence of the foreign bodies. During the study time the animals was categorized into three as young, adult and old and age of studied animals was estimated based on dentition pattern.

2.4. Sampling method and sampling size determination

The required sample size for this study was calculated based on the formula given by Thursfied (2005) based on required number of animals was 370. However, to increase precision the sample size was increased to 384. The expected prevalence (59.3%) (Tesfaye *et al*., 2012) of goat indigestible foreign bodies and the 5% desired absolute precision and 95% confidence interval (CI). Accordingly, the using 95% confidence interval and 0.05 absolute precision as follows: $n= 1.96^2$ x P exp (1-Pexp)/ d^2 Where n= required sample size P exp= expected prevalence d^2 = desired absolute precision (0.05) 1.96^2 = z- value for 95% confidence interval.

2.5. Study methodology

Ante mortem examination: Ante mortem examination on individual animals was done for assessment of age, sex and body condition of the animals. Age was categorized into young (<2 years), adult (3-4) years) and old (>4 years) based on dentition eruption according to Gatenby (1991). Body condition of goats were recorded as poor, medium and good based on the appearance of the animal and manual palpation of the spine and transverse processes of the lumbar vertebrae according to ESGPIP (2008). During Ante mortem examination each animals was marked for the identification by marking on its skin by using color.

Postmortem examination: In the postmortem examination rumen and reticulum was examined. Immediately after slaughter in the evisceration stage, the stomach was carefully removed from the abdominal cavity opened and was explored for the presence of any foreign non-dietary material by visualization and palpation. Any foreign bodies obtained during inspection was washed with water to removing adhering feed material and identified.

2.6. Data management and analysis

The data collected was entered and scored in Microsoft excel before subjected to statistical analysis, the data was thoroughly screened for errors and properly coded. For analysis, SPSS Microsoft software Version 20 was used.

3. Results

A total of 384 goats were examined for presence of indigestible foreign bodies in their rumen and reticulum. Out of these, 193 (50.26%) were found to have various types of indigestible foreign bodies in the rumen and reticulum. The types of foreign bodies detected were plastic, cloth, wire, and rope. The most commonly observed foreign bodies were plastics 180 (46.9%) followed by cloth 3(0.8%), rope 3(0.8%), plastic and cloth 3(0.8%), plastic and rope 3(0.8%) and wire 1(0.26%) in order of occurrence.

3.1. Prevalence of indigestible foreign body types in the rumen and reticulum

From 193 positive cases of foreign body, 192 (50%) were occurred in rumen while only 1(0.26) in reticulum. The types of foreign bodies encountered and their frequency of occurrence was summarized in table 1. Significantly higher prevalence (p= 0.00) of indigestible foreign bodies was found in rumen (50%) than reticulum (0.26%). The odd of occurrences of indigestible foreign bodies in rumen was 0.730 times more likely than reticulum (Table 1).

	Frequency of indigestible foreign body						**Association**				
Organs	Plastic	Cloth	Rope	Wire	Plastic and cloth (%)	Plastic and rope (%)	Overall (%)	Prevalence (%)	OR	(95% CI)	p-value
Rumen	180 (46.9)	3(0.8)	3(0.8)	-	3 (0.8)	3 (0.8)	192 (50)	50	0.73	0.501-0.650	0
Reticulum	-	-	-	1(0.26)	-	-	1(0.26)	0.26			
Total	180(46.9)	3(0.8)	3(0.8)	1(0.26))	3(0.8)	3(0.8)	193(50.26)	50.26			

Table 1: Prevalence of indigestible foreign body types in the rumen and reticulum.

3.2. Risk factor associated with foreign body ingestion

From total of 384 goat examined, higher foreign body prevalence was observed in the older animals (old) 54(54.97%) followed by adult 75(49.34%) and lower prevalence was observed in young age groups 24 (39.3%). The odd of foreign body occurrence in old goat was 1.297 times more likely than young goat. This variation in the foreign body prevalence was found statistically significant ($p<0.05$) (table 2).

Poor body conditioned goat were found to have highest prevalence of harboring indigestible foreign body 53(61.63 %)) and in contrary good body conditioned goat were found to have lowest indigestible foreign body prevalence 49(43.36%). The most prevalent foreign body were a plastic (46.9%) which was the most frequently recovered foreign body type in thin and medium body conditioned goat. Cloth was encountered in poor and good body conditioned goat. Rope was encountered in medium and good body conditioned goat and good body conditioned goat were found to have plastic, cloth, rope and wire. The odd of foreign body occurrence in poor body goat was 0.717 more likely than good body condition goat (Table 2). There was significant statistical difference ($p = 0.039$) between different body condition categories.

The prevalence in relation sex was also found to be non-significantly and higher in female 155 (52.19%) than male 38(43.68). Females were found to be 0.827 times more susceptible than males (OR=0.827, CI=0.503-1.360, p=0.460).

Risk factors		No. examined	Frequency and prevalence of occurrence							Association		
			Plastic (%)	Cloth (%)	Rope (%)	Wire (%)	Plastic and cloth (%)	Plastic and rope (%)	Overall (%)	OR	(95% CI)	P-value
Age	Young	61	21(34.4)	3(4.9)	0	0	0	0	24(39.3)	1.297	0.977-1.722	0.004
	Adult	152	70(46.5)	0	3(1.97)	0	1(0.658)	1(0.658)	75(49.34)			
	Old	171	89(52.04)	0	0	1(0.585)	2(1.17)	2(1.17)	94(54.97)			
	Total	384	180(46.9)	3(0.8)	3(0.8)	1(0.26)	3(0.8)	3(0.8)	193(46.9)			
Body Condition	Poor	86	49(56.98)	1(1.163)	0	0	2(2.33)	1(1.16)	53(61.63)	0.717	0.535-.961	0.039
	Medium	185	87(47.02)	0	1(0.54)	0	1(0.5)	2(1.08)	91(49.19)			
	Good	113	44(38.94)	2(1.77)	2(1.77)	1(0.885)	0	0	49(43.36)			
	Total	384	180(46.9)	3(0.8)	3(0.8)	1(0.26)	3(0.8)	3(0.8)	193(50.26)			
Sex	Female	297	144(48.48)	3(1.01)	2(0.67)	1(0.34)	2(0.67)	3(1.01)	155(52.19)	0.827	0.503-1.360	0.460
	Male	87	36(41.38)	0	1(1.14)	0	1(1.14)	0	38(43.68)			
	Total	384	180(46.9)	3(0.8)	3(0.8)	1(0.26)	3(0.8)	3(0.8)	193(50.26)			

Table 1: Prevalence of different foreign body and multivariable logistic regression analysis of factors associated foreign body ingestion.

4. Discussions

Ingestion of indigestible foreign materials by ruminants is a common worldwide problem and has been reported from different area of Ethiopia in both cattle and small ruminant (Tiruneh and Yesuwork, 2010; Fromsa and Mohammed, 2011; Negash *et al*., 2015; Fasil, 2016).This study showed an overall rumen and reticulum foreign body prevalence of 50.26% (193/384) in goat slaughtered at Haramaya municipal abattoir.This finding is relatively lower compared to 59.3% report from eastern Ethiopia at Haramaya University and Haramaya municipal abattoirs (Negash *et al*., 2015). This result is far higher than the reports of Firomsa and Nura, (2011) who reported 4.68% rumen foreign body in goat Slaughtered at Luna Export Abattoir, East Shoa, Ethiopia and 27% at Jijiga Municipal Abattoir (Fasil, 2016), 16.7% at Asella Municipal Abattoir (Teshome *et al.,* 2017) and 11.9% at Bahirdar municipality abattoir and hotels in Bahirdar town (Sheferaw *et al*., 2014). It was little bit higher than 46% at Addis Ababa Municipality Abattoir (Mekuanint *et al.,* 2017). It also disagrees with study in Nigeria by Remi-Adewunmi *et al*. (2004) and Hargessa (Omar *et al*., 2018) who reported 20.7%, 40% respectively. These differences in the prevalence of foreign bodies between various areas may be attributed to differences in animal management systems and the extent of foreign body management both in the rural and urban areas and in the grazing areas. The higher prevalence of foreign bodies in the current study area was probably related to the unrestricted and increased use of plastic bags and their improper disposal.

In this study non-significantly difference (P > 0.05) and higher prevalence of foreign body was observed in female (52.19%) than male (43.68%). It has agreement with study conducted by Teshome *et al.* (2017) who have reported prevalence rate 27.9% in female and 23.9% in male at Asella Municipal Abattoir South-eastern Ethiopia. This higher prevalence rate of foreign body in the female animals also was reported by Tiruneh and Yesuwork (2010). This sex dependent difference in the prevalence of the foreign body in the rumen may be attributed to hormonal changes and

increased appetite due to nutritional demands during estruses, pregnancy and lactation in female animals. Furthermore, females generally have a longer life span than males, as livestock farmers normally do not sell.

The current study indicated as larger number of foreign bodies occurred in the rumen (50%) than reticulum (0.26%) of goat. This may be due to the fact that many ingested feed goes to the rumen due to its larger size as compared to reticulum. In agreement with this finding, different scholars have reported higher frequency of foreign bodies from rumen than from the reticulum (Tiruneh and Yesuwork, 2010; Fromsa and Mohammed, 2011; Negash *et al*., 2015; Fasil, 2016). This study revealed that plastics were the most commonly encountered (46.9%) foreign material in all study animals, followed by cloth (0.8%), rope (0.8%) and wire (0.26%). This finding is in general agreement with various reports from different areas of Ethiopia (Abebe and Nuru 2011; Roman and Hiwot 2010; Sheferaw *et al.,* 2014; Tesfaye *et al*., 2012b), Nigeria (Igbokwe *et al*., 2003; Remi-Adewunmi *et al*., 2004). This indicates the widespread use of plastic bags in these areas and environmental pollution due to their improper disposal. Plastics and other materials that are not able to decompose have not only direct effect on the animals, but also can remain in the environment for a long time which ultimately affect the soil fertility and thus may reduce the quality and quantity of pasture in the environment (Sheferaw *et al*., 2014).

Older goat (> 4 years) (54.97 %) and goat having poor body condition (61.63%) were found to be more frequently harboring indigestible foreign body. In agreement with this finding there are reports from different area of Ethiopia and other country that older and thin animals to be more harboring indigestible foreign body (Remi-Adewunmi *et al*., 2004; Fromsa and Mohammed, 2011; Tiruneh and Yesuwork, 2010; Negash *et al.,* 2015; Fasil, 2016) and this difference are also statistically significant. The finding of significantly more foreign bodies in older animals than the young ones may be due to the gradual ingestion of indigestible materials over the prolonged period of time. The more frequent occurrence of rumen and reticulum indigestible foreign body in poor body goat might be attributed to the interference of the foreign body with the absorption of volatile fatty acids causing reduced weight gain (Remi- Adewunmi*et al*., 2004).

Conclusion and Recommendations

This study indicated that of 50.26% prevalence of indigestible rumen and reticulum indigestible foreign body shows the widespread distribution of plastic bags in the environment as a result of improper disposal of waste. Ingestion of metallic and non- metallic foreign bodies by goats are the most important not only because of their mortality but also it contributes a lot for animals output. Most of the non-metallic foreign bodies lodged in rumen, while metallic foreign bodies lodged in reticulum. So, it is a problem for individual in particular and the country in general. The study also showed that littering the environment with plastic bags and other indigestible materials could pose serious health problem for free grazing ruminants. Unless appropriate measure is taken increased ingestion of indigestible foreign bodies could pose serious health problem for free grazing goat particularly in urban and per-urban areas and negatively affect their overall productivity and production.

Based on the above conclusion, the following recommendations are forwarded:

- Proper waste disposal practices and good husbandry methods are required to prevent animals from accessing indigestible foreign bodies.
- Policy makers, veterinarians and environmental health experts are expected to work conjointly in reducing its adverse effect in animals.
- Study should be conducted to determine the occurrence of foreign bodies with economic impact.
- Furthermore, in order to reduce the problems associated with plastic bag wastes, it is recommended to aware the community how to manage disposal of plastic bags, rope, cloth and wire and as well as the periodical cleaning of these wastes in the grazing area.

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