

Prevalence of Indigestible Rumen and Reticulum Foreign Bodies in Cattle Slaughtered at Kombolcha Elfora Abattoir, Kombolcha Town, Amhara Regional State, Ethiopia

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ABSTRACT

Ingestion of indigestible foreign materials by ruminants is a common worldwide problem. A cross-sectional study was conducted at Kombolcha ELFORA abattoir, Ethiopia from November 2018 to April 2019 to assess the prevalence, type and potential risk factors associated with the occurrence of foreign bodies in the rumen and reticulum in cattle slaughtered at the abattoir. A systematic random sampling technique was used for selecting the study animals brought to Kombolcha ELFORA abattoir. From a total of 384 animals examined, 144 (37.5%) were found positive for the occurrence of indigestible foreign bodies in the rumen and reticulum. Sand (12.2%) and plastic bags (8.9%) were the most frequently found foreign body type. Prevalence was compared among sex, age group, body condition and origin of studied animals. There was a significant association for the prevalence of indigestible rumen and reticulum foreign body with sex ($X^2=6.58, p<0.05$), age ($X^2=26.09, p<0.05$) and body condition ($X^2=34.43, p<0.05$). The origin of animals showed no statistically significant difference ($X^2=13.50, p>0.05$). A higher percentage of foreign bodies occurred in the reticulum 73(19.1%) than in the rumen 57(14.8%) and the rest in both rumen and reticulum 14(3.6%). This study showed that the presence of indigestible foreign body is a common problem in cattle slaughtered at Kombolcha ELFORA abattoir. Therefore all concerned body including the government, animal health professionals, farmers, and others should act collaboratively to alleviate the problem.

Keywords: Abattoir; Cattle; foreign body; Kombolcha ELFORA abattoir; Reticulum; Rumen

INTRODUCTION

Ethiopia has livestock population estimated to be 53.4 million cattle, 25.5 million sheep and 22.78 million goats (CSA, 2011). Despite the large livestock population of Ethiopia, the economic benefits remain marginal due to

prevailing diseases, poor nutrition, poor animal production systems, reproductive inefficiency, management constraints and general lack of veterinary service (Sisay, 2007).

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A boost in food production in relation to an increase in the global population number that will reach about 10 billion in the near future is the most important concern. Especially, in developing countries where the rate of population growth is high, effective food production, particularly on an immediate increase in production of animal protein has been required for insuring a sufficiency of nourishment for the nation (JIAC, 2000). Livestock production in developing countries are characterized by rapid change, driven by factors such as population growth, increases in the demand for livestock products as incomes rise and urbanization (FAO, 2010).

Ingestion of indigestible foreign materials by cattle and buffaloes is a common problem worldwide, known as foreign body syndrome (FBS) (Aref & Abdel-Hakim, 2013). Cattle are more likely to ingest foreign bodies than small ruminants due to indiscriminate feeding behavior since they do not use their lips for prehension and the hard palates do not feel foreign body (Rebhun, 1995). Moreover, cattle with mineral deficiencies seem to relish objects with a mineral or metallic taste (Krishnamurthy et al., 1998).

Indigestible foreign bodies can cause different complications to the animal that poses a guarded prognosis due to leakage of the stomach and intestinal contents into the abdominal cavity results in infection of the peritoneum, peritonitis and sepsis. Some penetrate the wall of reticulum and diaphragm manifests the symptoms of Traumatic reticulitis (Blood & Hutchins, 1955). It also hampers the absorption of volatile fatty acids (VFA) leading to a reduction in the rate of animal fattening (Igbokwe et al., 2003).

In Ethiopia, cattle are managed extensively under the poor farming system and there is recurrent drought which makes them prone to be exposed to ingestion of indigestible foreign materials from different sources due to feed scarcity, high environmental contamination with plastic bags, construction materials, and the growing trend of urbanization and industrialization.

However, there is limited information about the prevalence of foreign bodies ingested by ruminants and risk factors for the occurrence of indigestible forestomach foreign bodies at the national level in general and in and around Kombolcha town in particular. Thus, this study was conducted to assess the prevalence and types of foreign bodies in the rumen and reticulum and the associated risk factors in cattle slaughtered at Kombolcha ELFORA abattoir

MATERIALS AND METHODS

2.1. Description of Study Area

The study was conducted at Kombolcha ELFORA abattoir, in Kombolcha town from November 2018 to April 2019. Kombolcha is located 376.4 km North-East of Addis Ababa, Amhara Region, it has a latitude and longitude of 11°5'N 39°44'E / 11.083°N 39.733°E with an elevation between 1842 and 1915 meters above sea level. In the region, there are three main seasons per year: the dry season (“Belg”) that lasts from October to the beginning of January with small rainfall of 100-300mm, and the big rainy season (“Kiremt”) from July to the end of September which has got average rainfall of 200-800mm. There is also a small dry period in May and June (BoARD, 2006).

2.2. Study Animals

The study was conducted on 384 apparently healthy cattle slaughtered at Kombolcha ELFORA Abattoir from November 2018 to April 2019. The animals were originated from different agro-ecological zones namely Kombolcha, Senbete, Chefa, Woldia, Harbu, Kemise, Wenji and Haik. Large numbers of the animal brought to slaughtering were poor body condition and all were local breeds. Breed, age, body conditions, sex and origin of the studied animals were considered as risk factors for the occurrence of indigestible foreign bodies.

2.3. Study Design

A cross-sectional study was conducted from November 2018 to April 2019 at Kombolcha ELFORA abattoir with the objectives of estimating the prevalence, to know the potential risk factors and to identify types of

foreign bodies in the rumen and reticulum of cattle slaughtered at the abattoir.

2.4. Sample Size Determination and Sampling Method

The sample size was determined according to the formula given by Thrusfield (2005) $n = (1.962 \times P \exp (1-P \exp) / d^2$, Where n = required sample size, $P \exp$ = expected prevalence and d^2 = desired absolute precision (0.05) for an infinite population with 95% confidence level, 5% desired absolute precision, and 50% expected prevalence. Therefore, 384 animals were enough to establish the prevalence. The abattoir was visited three days per week and during each day; the animals were selected systematically with an interval of every five animals to observe the occurrence and types of the foreign bodies in the rumen and reticulum.

2.5. Study Methodology

2.5.1. Antemortem Examination

During Ante mortem examination each animal was first marked by non-water soluble paint with unique code on their gluteal muscle for ease of identification. Then sex, age, breed, body condition and origin of individual animals were recorded on ante mortem recording sheet. The age of the animals was categorized as ≤ 4 and > 4 years based on standard given by Jenny Turton (2009). The body condition of the animals was visually determined according to Jaymelynn et al. (2016) as thin (poor), Borderline (medium) and optimum (good). However, no over-conditioned animal was brought for slaughter during the study period.

2.5.2. Postmortem Examination

The rumen and reticulum were manipulated to get rid of the ingesta on a surface built with cement and concrete provided with waste disposal and fresh source of pipeline water. The compartments were transversely cut to separate and then each compartment was longitudinally sliced. Contents were carefully emptied while inspecting for any material which is not of animal feed and was classified as IFB. When the materials were unclearly identified, they were washed with tap water for clear visibility and identification. The

encountered IFB was recorded for each compartment in which it was found. When possible, identified objects were photographed.

2.6. Data Management and Statistical Analysis

The data collected were entered in Ms excel worksheet and analyzed by using STATA Version 13. Descriptive statistical analysis such as calculation of percentage was used and table was used to present the analyzed data. Prevalence was estimated as the number of animals positive for IFB from the total animal examined. Pearson chi-square (X^2) test was calculated to know the association between prevalence and the potential risk factors. The significant level was set at 0.05.

RESULTS

3.1. Prevalence of Foreign Bodies

From a total of 384 cattle examined, 144 (37.5%) animals had foreign bodies in their rumen and/or reticulum. Out of the total, 57(14.8%) occurred in the rumen while 73(19.1%) were in the reticulum and 14(3.6%) were found in both compartments. Sand, Plastic bag, Rope, Cloth, Leather, Wire, Nail, Stone, Sack thread, Coin and Watch cover steel were encountered singly and/or mixed with each other during the study period (Table 1).

3.2. Risk Factors Associated with the Occurrence of Indigestible Rumen and Reticulum Foreign Body (IFB)

Out of 384 total animals examined, 242 were male and 142 were female. From 242 male animals 79 (32.6%) and from 142 female animals 65 (45.8%) was positive to IFB. Statistical analysis showed that there is a highly significant difference between the two sexes for the occurrence of foreign bodies ($X^2=6.58$; $p=0.01$). From total animals, 154 were grouped as in ≤ 4 and 230 were in > 4 years category, with this respective age group 34 (22.1%) and 110(47.8%) were found positive respectively. Foreign bodies were more frequently encountered in animal > 4 years than ≤ 4 years. The statistical analysis also showed that there exists a highly significant difference between the age groups ($X^2 = 26.09$; $p= 0.00$).

Of the total examined animals, 203, 118 and 63 were with poor, medium and good body conditions respectively. A prevalence of 49.3% (100/203), 32.2% (38/118) and 9.5% (6/63) were recorded in poor, medium and good body conditioned animals respectively. There were statistically significant differences ($X^2=34.43$; $p=0.00$) among animals with different body conditions and foreign body distribution in rumen and reticulum (Table 1).

Based on origin, animals were coming from Senbete 20.9% (9/43), Haik 34.0% (17/50), Wenji 21.7% (5/23), Kemise 50.9% (27/53), Kombolcha 35.9% (14/39), Woldia 45.0% (27/60), Harbu 36.4% (12/33), and Chefa 39.7% (33/83) were positive to the IFB, respectively. The highest frequencies of rumen and reticulum foreign bodies observed in cattle originated from Kemise (50.9%) while the lowest is from Senbete (20.9%). However, there were no statistically significant

differences among the origin of animals ($X^2=13.50$; $p=0.061$).

3.3. Types and Frequency and Distribution of Indigestible Foreign Bodies in the Rumen and Reticulum

From a total of 144 cattle found positive for a foreign body in the rumen and/or reticulum, 57 (14.8%) occurred in the rumen while 73 (19.1%) in the reticulum and 14 (3.6%) were found in both compartments. Most of the non-metallic objects like plastic bags, cloth, leather, rope etc were found in the rumen; while reticulum was the major site for the retention of metallic objects and sands. The statistical analysis also showed that the distribution of the foreign bodies were highly significant ($p=0.00$) in the rumen and/or reticulum. The sand was the most frequently encountered 47(12.2%) foreign body type followed by plastic bag 34(8.9%) and wire 9(2.3%) (Table 1), with $x^2=967.680$ $p=0.000$ which is statistically significant.

Table 1: Types, Frequency, and Distribution of Foreign Bodies in Fore stomach of Cattle slaughtered at Kombolcha ELFORA abattoir

Type of foreign body	Location			Total
	Rumen	Reticulum	Both	
Sand	-	47(64.4%)	-	47(12.2%)
Plastic bag	28(49.1%)	2(2.7%)	4(28.6%)	34(8.9%)
Wire	-	9(12.3%)	-	9(2.3%)
Rope	8(14.0%)	-	-	8(2.1%)
Leather	7(12.3%)	-	-	7(1.8%)
Cloth	5(8.8%)	-	-	5(1.3%)
Stone	-	4(5.5%)	-	4(1.0%)
Nail	-	1(1.4%)	-	1(0.3%)
Coin	-	1(1.4%)	-	1(0.3%)
Sack thread	2(3.5%)	-	-	2(0.5%)
Watch cover steel	-	1(1.4%)	-	1(0.3%)
Rope and Sand	-	1(1.4%)	5(35.7%)	6(1.6%)
Wire and Sand	-	5(6.8%)	-	5(1.3%)
Plastic bag and Cloth	4(7.0%)	-	-	4(1.0%)
Plastic bag and Rope	1(1.8%)	-	1(7.1%)	2(0.5%)
Wire and Cloth	-	-	1(7.1%)	1(0.3%)
Stone and Sand	-	1(1.4%)	-	1(0.3%)
Sand and Cloth	-	-	1(7.1%)	1(0.3%)
Plastic bag and Sand	-	-	1(7.1%)	1(0.3%)
Nail and Sand	-	1(1.4%)	-	1(0.3%)
Cloth and Leather	1(1.8%)	-	-	1(0.3%)
Plastic bag, Rope and Cloth	1(1.8%)	-	-	1(0.3%)
Rope, Wire and Sand	-	-	1(7.1%)	1(0.3%)
Total	57(14.8%)	73(19.1%)	14(3.6%)	144(37.5%)

Table 2: the Prevalence and Risk Factors Associated with Rumen and Reticulum Foreign Body in Cattle Slaughtered at Kombolcha ELFORA Abattoir

Risk factors	No. of Animal examined	No. of Animal found positive (%)	95% CI	Chi-square	p-value
Sex				6.58	0.010*
Male	242	79 (32.6)	26.8-38.9		
Female	142	65 (45.8)	37.4-54.3		
Age				26.09	0.000*
≤ 4years	154	34 (22.1)	15.8-29.5		
>4years	230	110(47.8)	41.2-54.5		
Body condition				34.43	0.000*
Poor	203	100 (49.3)	42.2-56.3		
Medium	118	38 (32.2)	23.9-41.4		
Good	63	6 (9.5)	3.6-19.6		
Origin				13.50	0.061
Senbete	43	9 (20.9)	10.0-36.0		
Haik	50	17 (34.0)	21.2-48.8		
Wenji	23	5 (21.7)	7.5-43.7		
Kemise	53	27 (50.9)	36.8-64.9		
Kombolcha	39	14 (35.9)	21.2-52.8		
Woldia	60	27 (45.0)	32.1-58.4		
Harbu	33	12 (36.4)	20.4-54.9		
Chefa	83	33 (39.7)	29.2-51.1		
Total	384	144 (37.5)	32.3-42.5		

DISCUSSIONS

Ingestion of indigestible foreign materials by ruminants is a common worldwide problem previously reported from Kenya (Otsyina et al., 2015), Tanzania (Bwatota et al., 2018), Nigeria (Igbokwe et al., 2003 and RemiAdewumi et al., 2004), Jordan (Hailat et al., 1996 and Ismail et al., 2007), Sudan (Ghurashi et al., 2009) and Pakistan (Anwar et al., 2013). This study showed an overall rumen and reticulum foreign body prevalence of 37.5% (144/384) in cattle slaughtered at Kombolcha ELFORA abattoir.

The present finding is significantly higher than the previous studies in Ethiopia reported by Desiye and Mersha (2012) who reported 13.22% of rumen and reticulum foreign body in cattle slaughtered at Jimma Municipal Abattoir, Teshome et al. (2017), who reported 14% of indigestible foreign bodies in rumen and reticulum of cattle slaughtered at Asella Municipal abattoir, Berrie et al. (2015) reported 14.8% IFB in rumen and reticulum in cattle slaughtered at Gondar Elfora abattoir, Rahel (2011), who reported 17.07% of prevalence of forestomach foreign bodies in Hawasa municipal abattoir, a prevalence of 23.9% reported at Hirna municipal abattoir by Dawit et al. (2012), a

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prevalence of 17.16%, obtained by Bassa and Tesfaye (2017) in cattle slaughtered at Wolaita Sodo municipal abattoir. The finding also significantly higher than study done in Uganda by Mushonga et al. (2015) who reported 17.4% prevalence of foreign bodies in the fore-stomach of cattle at Ngoma Slaughterhouse and in Tanzania, 24.03% prevalence of indigestible rumen and reticulum foreign body obtained in cattle slaughtered at Morogoro municipal slaughterhouse reported by Bwatota et al. (2018).

However, the prevalence of the current study (37.5%) is relatively lower than the previous finding in Ethiopia by Negash et al. (2015), who reported a prevalence of 43.4% indigestible foreign bodies in the rumen and reticulum of cattle in eastern Ethiopia. Moreover, the current study is far lower than the study in Pakistan by Anwar et al. (2013) reported a prevalence of indigestible rumen and reticulum foreign bodies in Achai cattle at different regions of Khyber Pakhtunkhwa about 59.14%. In addition, Ismail et al. (2007) reported 77.41% prevalence of non-metallic foreign bodies in a clinical ill with recurrent rumen tympany and surgically treated (rumenotomy) in adult dairy cattle in Jordan.

The differences in the prevalence of indigestible foreign bodies observed among different areas may be attributed to the environmental variations in the origin of the animals, husbandry practices, feeding behavior, and the waste management system or the level of environmental pollution at the source rather than the animal being the cause (Otsyina et al., 2015). Higher prevalence of foreign bodies in the current study area is probably related to feed scarcity, the growing trend of construction of different infrastructures, the unrestricted and increased use of plastic bags and their improper disposal. Ingestion of foreign bodies is associated with a shortage of forage (Hailat et al. 1996) as well as increased pollution of grazing lands with indigestible materials (Tesfaye et al., 2012a). If owners do not provide supplementary feed during feed shortages, their animals are likely to face a negative energy balance that will force them to ingest foreign bodies in their immediate surroundings including plastic, cloth, rope and even metallic objects (Hailat et al., 1996). In urban areas, it is common to see animals eating plastic bags attracted by the food disposed of within plastic bags.

The study revealed that there is statistically significant difference in prevalence of indigestible foreign bodies in rumen and reticulum between female and male animals and this agrees with the finding of Mushonga et al. (2015) and Tiruneh and Yesuwork (2010), they pointed out that females generally have a longer lifespan than males, as livestock farmers normally do not sell females because they reproduce and increase the herd size. They also alluded to the fact that pica, which caused the animals to pick up strange objects like food, is normally more frequent in pregnant than in non-pregnant animals. In this study, the higher prevalence of indigestible foreign bodies in female cattle may be explained by the fact that male animals are used for draught power and heifers and bulls sent for grazing, which is far from dwelling areas, but dairy cows are kept around the homestead for milking purpose and to feed their calf which makes them prone to ingest indigestible foreign materials.

Moreover, it is common to keep dairy cows than male animals in urban areas. Lactating animals are more prone to nutritional deficiency and thus highly exposed to IFB as explained by Radostitis et al. (2007) that old dairy cattle are the most commonly affected group, this makes female animals highly exposed than males.

The study showed a higher prevalence of indigestible foreign body in cattle with the age >4 than cattle ≤ 4 . This agrees with the finding of Bwatota et al. (2018), with the argument that the high prevalence of IFB in cattle greater than four years with prolonged exposure to the contaminated environment. Previous reports of Mekuanint et al. (2017), Tesfaye and Chanie (2012), Berrie et al. (2015) and Churko and Elcho (2017) have also shown a higher prevalence of IFB in older cattle than in young cattle.

In this study, animals with poor body condition are significantly affected with indigestible rumen and reticulum foreign body (49.3%) than with medium body condition (32.2%) and good body conditioned animals (9.5%). The difference between the body condition of animals was statistically significant $p < 0.05$. This is in line with the finding of Desiye and Mersha (2012). The low body condition by itself might be due to the contribution of the foreign body by which the animal loss weight after it has been exposed or it might be due to the interference of foreign body with the absorption of volatile fatty acid (VFA) and thus causes reduced weight gain (Roman & Hiwot 2010). Accumulations of indigestible foreign bodies in the rumen interfere with the flow of ingesta (Igbokwe et al., 2003) and with the absorption of feed. These effects most likely contributed significantly to animals being in poor body condition and may have played a significant role in preventing a percentage of those in medium body condition who had foreign bodies from attaining good body condition and thus causing their owners to incur significant financial losses (Negash et al., 2015). This may greatly affect fatteners who buy animals with poor and medium body conditions because animals with foreign bodies do not

attain the desired body condition during the fattening period.

In the current study, the origin of studied animals showed statistically insignificant relation for the occurrence of foreign body $p > 0.05$. Though the highest prevalence was observed in cattle originated from Kemise and the lowest prevalence was observed in cattle originated from Senbete. Different studies have shown that ruminants reared in urban and suburban areas have high probabilities to ingest indigestible materials such as plastic, cloth, wire, leather and metal Teshome et al. (2017). Ingestion of indigestible foreign bodies by animals is mainly associated with nutritional deficiencies, environmental pollution and poor feeding management Negash et al. (2015).

This study showed that a much higher prevalence of indigestible foreign bodies in the reticulum than in the rumen. This disagrees with previously reported a higher prevalence of IFB in the rumen (Mushonga et al., 2015; Berrie et al., 2015 and Tesfaye et al., 2012) than in reticulum. They attributed their findings to the larger volume of rumen compared to other compartments, and almost all ingested feed, especially of low density, settles in the rumen. The reticulum is the most cranial compartment of the forestomach; its mucosa is thrown up into intersecting ridges that give the reticulum its common name, the “honeycomb.” Foreign objects such as wire or nails that are swallowed typically will fall into and remain in the reticulum Rowen et al. (2009). The study also showed most metallic and heavy materials like sand and stone found in the reticulum while non-metallic and low-density materials occurred in the rumen which agrees with Radostits et al. (2007). This may be correlated to the honeycomb structure of the reticulum and the ventral location of the compartment leads to retaining metallic and heavy materials. The high quantities of indigestible foreign bodies found in the reticulum in the current study were due to the high prevalence of sand together with wire and stone which retains in the reticulum.

The type of foreign body encountered in rumen and reticulum of examined animals

in this study were sand, plastic bag, wire, rope, leather, cloth, stone, nail, coin, sack thread and watch cover steel. From them, sand was the most frequently occurring foreign body (12.2%) in cattle slaughtered at Kombolcha ELFORA abattoir. Almost similar types of foreign bodies were reported by Anwar et al. (2013) and Sileshi et al. (2013). The higher prevalence of sand in the study probably related to the scarcity of rain in and around Kombolcha town that leads animals to graze along the riverside and drink sandy water. The next highly prevalent foreign body was a plastic bag (8.9%) which is related to improper disposal of household wastes that have food taste to attract animals to ingest.

CONCLUSION AND RECOMMENDATIONS

In this study, higher prevalence (37.5%) of rumen and reticulum foreign bodies was recorded in cattle slaughtered at Kombolcha ELFORA abattoir. The risk factors such as sex, age and body condition of animals were found significantly related to the prevalence of IFB in the study area. Females were more affected by IFB than male animals. Lower number of animals with the age of ≤ 4 years were contained IFB than those with the age of > 4 years. Poor body conditioned animals were found the most affected group followed by medium whereas good body conditioned animals were least affected. However, the origin of animals had no significant association. Different types of foreign materials were encountered during the study period amongst sand constituted the major part followed by plastic bags. This finding indicates that there were suitable grounds for exposure of the animals to IFB, thus pose a huge problem for the production and reproduction efficiency of the animals in the area.

Therefore, based on the above conclusion the following recommendations are forwarded:

- Animal health professionals in collaboration with other concerned bodies should aware of the public about proper waste disposal systems.

- Livestock keepers or farmers should avoid letting their animals graze on the area contaminated with indigestible foreign bodies.
- The government should devise a policy concerning the manufacturing and usage of plastic bags.
- Further research should be conducted to identify the deep-rooted problem for the occurrence of an indigestible foreign body and show how to mitigate it.

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