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Journal Articles

PREVALENCE OF NON-DIGESTIBLE RUMEN FOREIGN BODIES IN GOATS AND SHEEP IN BALKH ABATTOIR, NORTHERN AFGHANISTAN

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SUMMARY

Ruminant ingestion of non-digestible, rumen foreign bodies has become a global concern due to feed shortages and an increase in the proportion of non-digestible materials polluting grazing areas. Therefore, this study aims to identify the prevalence and types of non-digestible foreign bodies in goat and sheep rumens. A systematic random sampling technique was used to select 1415 small ruminants for slaughter at the Balkh abattoir from December 2021 to May 2022. A total of 265 goats and 1150 sheep were examined for non-digestible foreign bodies. It was found that 126 (8.9%) of the ruminants had non-digestible foreign bodies in their rumen. Of those 24 (9%) were goats and 102 (8.9%) were sheep. A higher prevalence of rumen foreign bodies (37.9%) was found in three to four-year-olds and females (10.2%) compared with males (6.3%) in both species. Out of 126 affected animals, 81 (16.8%) were from urban environments, while 13 (6.5%) and 32 (4.4%) were from peri-urban and rural areas, respectively. The foreign bodies comprised plastic bags (49.2%), cloths (13.5%), ropes (11.1%), metals (9.5%), hairballs (4.8%), leather (4%), stones (1.6%), and mixed materials (6.3%). The weight of the foreign materials ranged from 3 g to 2.6 kg. Environmental pollution at the animals' farm site is responsible for the foreign body occurrence in the rumen of goats and sheep, potentially harming their overall productivity and production in Balkh, Northern Afghanistan.

Keywords: Non-digestible rumen foreign bodies, goat, sheep, Balkh abattoir, Afghanistan

INTRODUCTION

Goats and sheep are crucial farmed species in Balkh, Northern Afghanistan, primarily due to their adaptability to harsh environments and high productivity (Kijas et al., 2012; Moradi et al., 2022). Massive environmental pollution, rapid urbanization, industrialization, acute mineral deficiency, drought periods, and pica predispose them to foreign body ingestion (Igbokwe et al., 2003; Ghurashi et al., 2009; Fesseha, 2020). Common clinical signs of rumen foreign body ingestion include milk reduction, rumen impaction, recurrent bloat, complete cessation of rumination, pale mucous membrane, reduced rumen motility, ruminal atony, anorexia, rough hair coat, and scant faeces (Vanitha et al., 2010; Nugusu et al., 2013). Rumen impaction is rarely diagnosed in live animals as they are asymptomatic and, thus, can only be investigated in abattoirs (Igbokwe et al., 2003). Ruminants commonly ingest foreign bodies when animal management is substandard, combined with poor nutritional conditions, forcing them to scavenge for food (Saulawa et al., 2012; Nugusu et al., 2013; Fesseha, 2020). Jordan has estimated that rumen impaction-related losses in sheep productivity and health costs are approximately USD 25 million (Hailat et al., 1997).

A majority (75%) of Afghans reside in rural regions and depend mainly on farming and animal husbandry for their daily needs. Nomads, such as the Kochi, rely solely on their animals for income generation. Afghanistan has 22 million sheep, 10 million goats, and 3.7 million cattle (ALCS 2016, 2017). The country's grassland area covers 47% of the total land area at approximately 30 million hectares (Moradi et al., 2022). The Balkh province produces roughly 2,100 tons of garbage daily, of which 65% is collected, and the other 35% is openly disposed of in public spaces without proper management (Balkh Municipality, 2022). As a result, the grazing lands are polluted with non-biodegradable and non-digestible materials. A previous study reported that rumen impaction is more common in goats and sheep reared in urban and peri-urban areas than in rural regions (Remi-Adewunmi et al., 2004).

Earlier investigations on non-digestible foreign bodies in ruminants' rumen reported varying findings. In Southern Darfur, Sudan, the prevalence of this condition is 81% and 85% in live and slaughtered goats, respectively (Ghurashi et al., 2009). Meanwhile, 11.6% of ruminants at the Zango slaughterhouse in Zaria, Kaduna State, Nigeria (Alawa et al., 2011), and 23.4% of goats and sheep at the Addis Ababa slaughterhouse in Ethiopia (Alemneh & Kolech, 2017) are affected by this problem. Therefore, this study aimed to identify the prevalence and types of non-digestible foreign bodies in goat and sheep rumens associated with their occurrence in Balkh, Afghanistan.

MATERIAL AND METHODS

Study area

The Balkh province is in northern Afghanistan and is bordered by three neighbouring countries: Uzbekistan (north), Tajikistan (northeast), and Turkmenistan

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(northwest). This province (36° 42' 33" N latitudes and 67° 6' 47" E longitudes) is 357 m (1,171 ft) above sea level (Figure 1) and covers an area of 16,840 km^2. More than 50% of Balkh's topography is mountainous or semi-mountainous, while the rest are flat lands (WFP, 2013). The town and its surroundings have mid-latitude, dry, semi-arid (Steppe) weather, with minimum and maximum temperatures of 27 °C and 39 °C. The relative humidity in this region ranges between 0.1% and 8%. The dry season lasts seven months (May to November), while the rest of the year experiences a wet season (December to April) comprising rain, snow, or a combination of both. Rain is the most frequent type of precipitation throughout the year, with a peak probability of 16% in March. The Balkh province has 14 districts, and the Balkh abattoir is in the Nahri Shahi (Mazar-i-Sharif) district.

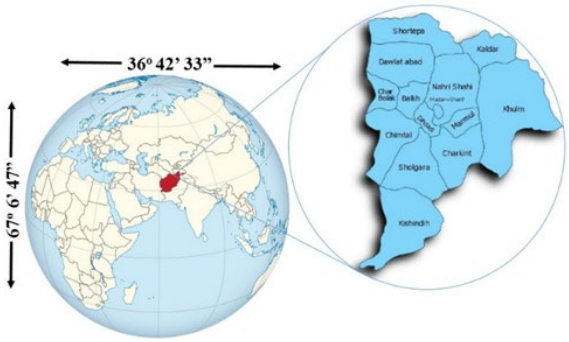

Figure 1. Map of Balkh province, Northern Afghanistan (Adapted from Wikipedia: Archivo: Afghanistan on the globe (Afghanistan centered).svg and Paintmaps.com)

Study design

Systematic random sampling was employed to select the goats and sheep for this study, every second animal was selected for slaughter until 20 animals were slaughtered at each visit regardless of species. Researchers visited the abattoir every Saturday, Monday, and Wednesday for six months (December 2021 to May 2022). Most animals in the Balkh abattoir were sourced from rural areas in the 14 Balkh districts; rural areas often have fewer than 2,000 housing units and 5,000 residents, with very larger pastures. Some animals were also obtained from peri-urban regions. Peri-urban areas are located on the outskirts of Mazar-i-Sharif city; they retain rural characteristics such as substantial reliance on agricultural and livestock production. Examples of peri-urban areas are Camp Sakhy, Ali Abad, Ablay, and Qezel Abad. The urban area is Mazar-i-Sharif, with the highest population density.

The selected animals were marked and observed throughout the slaughter process. The species, age, sex, body condition score (BCS), rumen impaction, and source of animals were evaluated. The animal's dentition was assessed to estimate the age based on the wear of the incisor teeth and appearance (eruption) (Otesile & Obasaju, 1982). Muscle and fat deposition on and around the vertebrae in the loin region were also measured to evaluate the animal's BCS on a scale of 1 to 5 (1: emaciated, 2: thin, 3: average, 4: fat, 5: obese). After the animals had been slaughtered, flayed, and eviscerated, a visual inspection and rumen incision were performed to determine rumen impaction and the presence of non-digestible rumen foreign bodies. Rumen impaction was determined based on the presence of non-digestible materials in the rumino-reticular orifices, which caused the blockage or obstruction of the rumen. Each foreign body recovered from the rumen was washed with water to remove its digested food (digest), which easily identified the types of foreign bodies by visual inspection. Then placed in a colander for a while until the excess water was removed and it took on a dry state, then weighed using a premier digital weighing scale – PM – 401 and photographed.

Data management and analysis

The post-slaughter findings, species, age, sex, BCS, rumen impaction and source of animals were tabulated in Microsoft Excel 2013 (Microsoft, USA). The data were later imported into Graph Pad Prism software version 9 (Graph Pad Software LLC, USA) for analysis and presented using descriptive statistics.

RESULT

Prevalence of non-digestible foreign bodies in the rumen of goats and sheep at Balkh abattoir

A total of 126 (8.9%) animals were found positive for foreign bodies out of 1415 ruminants (265 goats, 1150 sheep). The majority of them were sheep (n = 102, 8.9%) and the remaining were goats (n = 24, 9%) (Table 1). Most animals examined were 1 – 2 and 2 – 3 years old, but the highest prevalence of non-digestible foreign bodies was present in animals aged 3 – 4 (37.9%) and > 4 (15.4%) years old. Meanwhile, 97/953 (10.2%) female and 29/462 (6.3%) male slaughtered animals had non-digestible foreign bodies in their rumens (Table 1).

Furthermore, the prevalence of non-digestible foreign bodies was high in animals with BCS 2 (21.6%) and 3 (6.6%), respectively. Of 126 ruminants with foreign bodies, 81 (16.8%) were from urban areas, 13 (6.5%) from peri-urban areas, and 32 (4.4%) were from rural regions.

Types of non-digestible foreign bodies in the rumen of goats and sheep at Balkh abattoir

The types of non-digestible foreign bodies found in slaughtered animals were plastic bags (49.2%), cloths (13.5%), ropes (11.1%), metals (9.5%), hairball (4.8%), leather (4%), stones (1.6%), and mixed materials (6.3%) (Table 2, Figure 2). Nonetheless, leather and stone were not found in goats. Plastic bags and cloths are the most common non-digestible foreign body material found in the rumen of both species. Dry weights of the different kinds of non-digestible foreign bodies found in individual goats and sheep during the study ranged from 3 g in a goat to 2.6 kg found in a sheep.

Table 1. Prevalence of non-digestible foreign bodies in the rumen of goats and sheep at Balkh abattoir

Parameters		Number of animals examined	Number of animals with non-digestible foreign bodies	Prevalence (%)
Species	Goat	265	24	9.0
	Sheep	1150	102	8.9
Age	< 1 year	147	13	8.8
	1 – 2 years	471	23	4.9
	2 – 3 years	755	77	10.2
	3 – 4 years	29	11	37.9
	> 4 years	13	2	15.4
Sex	Male	462	29	6.3
	Female	953	97	10.2
BCS	1	6	0	0
	2	250	54	21.6
	3	893	59	6.6
	4	246	12	4.9
	5	20	1	5
Source	Rural	733	32	4.4
	Peri-urban	200	13	6.5
	Urban	482	81	16.8

BCS: body condition score

Figure 2: A&B: Non-digestible foreign bodies found in sheep rumen; C&D: Non-digestible foreign bodies in goats' rumen.

Non-digestible foreign bodies affect female animals more than their male counterparts. Plastic bags had the highest frequency in the > 4 years age group (23.1%), followed by the 3 – 4 years (17.2%) animals. Meanwhile, plastic bags were rarely present in the rumen of 1 – 2 years ruminants. Cloth was most common in the 3 – 4 (6.9%) and 2 – 3 (1.3%) years groups. Metal, hairball, and stone were not found in animals > 4-year and < 1-year categories. Few animals had stone (n = 2), leather (n = 5), and hairball (n = 6) in their rumen. Interestingly, thinner animals tend to have higher non-digestible foreign bodies in their rumen, primarily with plastic bags (11.3%), rope (3.5%), and metal (3.5%) (Table 3).

Rumen impaction

Out of 126 animals with foreign bodies, 6 animals (1 goat and 5 sheep) were found to have rumen impaction. Of these, 2 were male, and 4 were female. Two animals aged < 1 year and four animals aged 3 – 4 and > 4 years old. Rumen impaction is more common in animals reared in urban areas (83.3%) than in rural regions (16.7%). Plastic bags, mixed materials, and clots were found in the impacted rumen.

DISCUSSION

Of the 1415 slaughtered goats and sheep at the Balkh abattoir, only 9% and 8.9% had ingested non-digestible foreign bodies. These results are relatively low compared to urban areas of Nigeria (77%) and South Darfur, Sudan (87%) (Remi-Adewunmi et al., 2004; Ghurashi et al., 2009). In contrast, Addis Ababa, Ethiopia, recorded a lower prevalence rate (6.1%) of non-digestible foreign bodies found in goats and sheep (Abebe & Nuru, 2011). In this study, most animals in the Balkh abattoir were sourced from rural areas. These animals grazed on natural pastures that were significantly less polluted than those in Balkh's urban and peri-urban areas. Furthermore, grazing land in urban and peri-urban areas is limited or almost nonexistent, posing a high risk for free-roaming and scavenging goats and sheep to ingest non-digestible foreign bodies (Hailat et al., 1997; Tesfaye et al., 2012).

Table 2. Types of non-digestible foreign bodies in the rumen of goats and sheep at Balkh abattoir

Species	Number of animals with non-digestible foreign bodies	Types of non-digestible foreign bodies							
		Plastic bag n (%)	Cloth n (%)	Rope n (%)	Metal n (%)	Hairball n (%)	Leather n (%)	Stone n (%)	Mixed n (%)
Goat	24	10 (41.7)	5 (20.8)	3 (12.5)	4 (16.7)	1 (4.2)	0	0	1 (4.2)
Sheep	102	52 (51.0)	12 (11.8)	11 (10.8)	8 (7.8)	5 (4.9)	5 (4.9)	2 (2)	7 (6.9)
Total	126	62 (49.2)	17 (13.5)	14 (11.1)	12 (9.5)	6 (4.8)	5 (4)	2 (1.6)	8 (6.3)

Table 3: Types and proportion of non-digestible foreign bodies in the rumen of goats and sheep

Parameters	Number of animals examined	Types of non-digestible foreign bodies							
		Plastic bag n (%)	Cloth n (%)	Robe n (%)	Metal n (%)	Hairball n (%)	Leather n (%)	Stone n (%)	Mixed n (%)
Male	462	18 (3.9)	2 (0.4)	0	1 (0.2)	0	3 (0.6)	1 (0.2)	4 (0.9)
Female	953	44 (4.6)	15 (1.6)	14 (1.5)	11 (1.1)	6 (0.6)	2 (0.2)	1 (0.1)	4 (0.4)
< 1 year	147	8 (5.4)	1 (0.7)	2 (1.4)	0	0	1 (0.7)	0	1 (0.7)
1 – 2 years	471	11 (2.3)	4 (0.8)	2 (0.4)	2 (0.4)	3 (0.6)	0	0	1 (0.2)
2 – 3 years	755	35 (4.6)	10 (1.3)	9 (1.2)	7 (0.9)	2 (0.3)	3 (0.4)	0	4 (0.5)
3 – 4 years	29	5 (17.2)	2 (6.9)	0	1 (3.4)	1 (3.4)	0	2 (6.9)	0
> 4 years	13	3 (23.1)	0	1 (7.7)	2 (15.4)	0	1 (7.7)	0	2 (15.4)
Thin	256	29 (11.3)	3 (1.2)	9 (3.5)	9 (3.5)	1 (0.4)	0	1 (0.4)	7 (2.7)
Medium	893	22 (2.5)	8(0.9)	4 (0.4)	2 (0.2)	5 (0.6)	4 (0.4)	1 (0.1)	1 (0.1)
Good	266	11(4.1)	6(2.2)	1(0.4)	1(0.4)	0	1(0.4)	0	0

Thin: body condition score (1&2); Medium: body condition score (3); Good: body condition score (4&5)

The prevalence of non-digestible foreign bodies in ruminants is relatively similar between goats and sheep, consistent with previous reports (Abebe & Nuru, 2011; Alemneh & Kolech, 2017). Nonetheless, several studies highlighted this condition is more prevalent in sheep than goats (Okai et al., 2007; Akinrinmade & Akinrnde, 2012; Teshome et al., 2017). On the contrary, study findings in Sudan and Kenya discovered more non-digestible foreign bodies in goats' rumen than sheep (Otsyina et al., 2015; Duresa et al., 2022). Differences in the husbandry practice can probably explain the different rates of rumen foreign bodies in goats and sheep, the animals' origins, waste management system, and feeding behavior instead of the animals' species (Igbokwe et al., 2003; Roman & Hiwot, 2010).

This study found that female animals ingest non-digestible foreign bodies more often than males, which is consistent with earlier studies (Roman & Hiwot, 2010; Teshome et al., 2017). This outcome could be attributed to female animals' increased appetite and nutritional demands during lactation, estrus, hormonal changes, and pregnancy. Furthermore, non-digestible materials are consumed gradually for long periods, suggesting that the higher prevalence is attributed to female animals often remaining at farm sites over long periods for breeding purposes (Hailat et al., 1997). Nonetheless, several studies reported contradictory findings (Abebe & Nuru, 2011; Saulawa et al., 2012). The current study also found that animals aged between 3 – 4 and > 4 years were more vulnerable to the impacts of ingesting non-digestible foreign bodies than those in the 2 – 3 years group. Meanwhile, the 1 –2 years group had the lowest percentage of plastic bags in their rumen, which aligned with earlier studies (Roman & Hiwot, 2010; Teshome et al., 2017). Dry weights of the different non-digestible foreign bodies ranged from 3 g to 2.6 kg in the current study. Weighing the non-digestible foreign bodies in the rumen serves several purposes in veterinary medicine, such as diagnostic purposes, treatment planning, monitoring and follow-up, research, and documentation.

A higher prevalence of the rumen foreign bodies was found in goats and sheep with poor body conditions, similar to previous findings (Remi-Adewunmi et al., 2004; Saulawa et al., 2012; Teshome et al., 2017). Poor body condition and the presence of rumen foreign bodies were attributed to interference in abdominal distention, lack of defecation with consequent emaciation and recumbency, inappetence due to the rumen's absorption of volatile fatty acids, and reduced weight gain (Igbokwe et al., 2003).

Ruminal impaction is a condition characterized by the accumulation of feed material, usually dry or fibrous, in the rumen of ruminant animals. This accumulation can obstruct normal rumen function and lead to various signs and symptoms such as decreased appetite, decreased or absent rumen contractions, distended abdomen, decreased or absent feacal output, abdominal discomfort, dehydration, and dullness (Bakhiet, 2008; Nugusu et al., 2013; Sangjin et al 2023). Non-digestible foreign bodies trapped in the honeycomb structure of the reticular mucosa are often found in the reticulum's lumen due to the gravitational pull of the heavy foreign materials towards the ventral part of the forestomach (Anwar et al., 2013). Despite that, the position of the impacted material in the rumen was more critical than the weight and size of the non-digestible foreign body in causing clinical impaction. Large and heavily impacted materials have no clinical effects on the rumen unless the rumino-reticular orifices are partially or entirely blocked by the pressure or presence of the materials (Igbokwe et al., 2003).

Improper waste disposal and management in the Balkh province pollutes the limited grazing land in the city. Numerous publications have confirmed that plastic bags are more frequently found in goats and sheep rumens than other non-digestible foreign bodies (Roman & Hiwot, 2010; Otsyina et al., 2015; Teshome et al., 2017). This finding indicates the high plastic waste and improper disposal, particularly in urban and peri-urban areas (Njeru, 2006; Roman & Hiwot, 2010; Adane & Muleta, 2011). Out of 126 affected animals by non-digestible rumen foreign bodies, 81 (16.8%) were from urban environments, while 13 (6.4%) and 32 (4.4%) originated from peri-urban and rural areas, respectively. Likewise, non-digestible foreign bodies were significantly higher in goats and sheep sourced from Nigeria's urban areas (Remi-Adewunmi et al., 2004).

CONCLUSIONS

Balkh Province is one of the developing provinces in Afghanistan. Renovation and reconstruction in this province substantially increase waste production. Environmental pollution could be the primary cause of the prevalence (8.9%) of non-digestible rumen foreign bodies in goats and sheep in urban and peri-urban areas, causing major health problems and harming the overall productivity and production of roaming and scavenging goats and sheep. The study findings also revealed that plastic bags are the most common foreign body found in the rumen of goats and sheep in Balkh. Therefore, proper waste disposal and management could significantly decrease the prevalence of non-digestible foreign bodies in ruminants.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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REFERANCES

Abebe, F., & Nuru, M. (2011). Prevalence of indigestible foreign bodies ingested by small ruminants slaughtered at Luna export abattoir, East Shoa, Ethiopia. J Anim Vet Adv, 10 (12), 1598-1602.

Adane, L., & Muleta, D. (2011). Survey on the usage of plastic bags, their disposal and adverse impacts on the environment: A case study in Jimma City, Southwestern Ethiopia. J Toxicol and Environ Hlth Sci, 3(8), 234-248.

Afghanistan Living Conditions Surve. (ALCS 2016-2017).

Akinrinmade, J.F., & Akinrinde, A.S. (2012). Prevalence of foreign body rumen impaction in slaughtered goats in Ibadan, Southwest Nigeria. Sahel J Vet Sci, 11: 39-42.

Alawa, C.B., Etukudo-Joseph, I., Alawa, J.N. (2011). A 6-year survey of pathological conditions of slaughtered animals at Zango abattoir in Zaria, Kaduna State, Nigeria. Trop Anim Health Prod 43: 127-131.

Alemneh, T., & Kolech, T. A. (2017). Indigestible Rumen Foreign Bodies - Causes of Rumen Impaction in Cattle, Sheep and Goats Slaughtered at Addis Ababa Abattoir Enterprise, Ethiopia. Journal of Veterinary Science & Medicine, 5(1), 01–05.

Anwar K., Khan I., Aslam A., Mujtaba M., Din A., Amin Y. and Ali Z. (2013). Prevalence of indigestible foreign bodies in Achai cattle at different regions of Khyber Pakhtunkhwa. Journal of Agricultural and Biological Science, 8(8): 580-586.

Bakhiet, A. O. (2008). Studies on the rumen pathology of Sudanese desert sheep in a slaughterhouse. Scientific Research and Essays, 3(7), 294–298.

Balkh Province Municipality, Afghanistan. (2022).

Duresa, L. A., Kitessa, J. D., & Feyissa, C. T. (2022). Prevalence of indigestible foreign bodies and their associated potential risk factors in the rumen and reticulum of domestic ruminants at Bishoftu Elfora Export Abattoir. Veterinary Medicine and Science, 8(6), 2623–2630.

Fesseha, H. (2020). Rumenotomy due to Metallic Foreign Bodies in the Rumen of Adult Dairy Cow. Biomedical Journal of Scientific & Technical Research, 27(3). 20824-20827

Ghurashi, M.A.H., Seri, H.I., Bakheit, A.H & Ashwag, E.A.M. (2009). Effect of surgical removal of foreign body from goat's rumen with special reference to the prevalence of foreign body in goats in Southern Darfur. Aust J Basic Appl Sci, 3(2), 664-668.

Hailat, N. S., Nouh, A., Al-Darraji, S.F., Lafi, F.A., Al-Aniand, A., & Al-Majali. (1997). Prevalence and pathology of foreign bodies (plastics) in Awassi sheep in Jordan. Small Rum Res, 24: 43-48.

Igbokwe, I.O., Kolo, M.Y. & Egwu, G.O. (2003). Rumen impaction in sheep with indigestible foreign body in the semi-arid region of Nigeria. Small Rum Res, 49(2), 141-147.

Kijas, J. W., Lenstra, J. A., Hayes, B., Boitard, S., Neto, L. R., Cristobal, M. S., Servin, B., McCulloch, R., Whan, V., Gietzen, K., Paiva, S., Barendse, W., Ciani, E., Raadsma, H., McEwan, J., & Dalrymple, B. (2012). Genome-wide analysis of the world's sheep breeds reveals high levels of historic mixture and strong recent selection. PLoS Biology, 10(2), 1-14.

Mohammed, S.S. (2012). A Retrospective Study on The Prevalence of foreign body in goat, sheep, and cattle in different seasons in Khartoum State, 2001-2011. Global Vet, 9: 732-737.

Moradi, M. H., Mahmodi, R., Farahani, A. H. K., & Karimi, M. O. (2022). Genome-wide evaluation of copy gain and loss variations in three Afghan sheep breeds. Scientific Reports, 12(1), 1–15.

Njeru, J. (2006). The urban political ecology of plastic bag waste problem in Nairobi, Kenya. Geoforum, 37: 1046-1058.

Nugusu, S., Velappagounder, R., Chandrashekhar Unakal, C., & Nagappan, R. (2013). Studies on Foreign Body Ingestion and their Related Complications in Ruminants Associated with Inappropriate Solid Waste Disposal in Gondar Town, North West Ethiopia. International Journal of Animal and Veterinary Advances, 5(2), 67–74.

Okai, B.D., Boateng, M., & Opoku Agyemang, H. (2007). Incidence of plastics in cattle, sheep, and goats. Proceedings of the 15th Ghana Society of Animal Production (GSAP) Conference, held at KNUST, Kumasi, Ghana. Aug 1-4: 119-123.

Otesile, E.B., & Obasaju, M.F. (1982): Relationship between age and rostral teeth development in Nigerian goats. In: Proceedings of the third international conference on goat production and disease, University of Arizona, Tucson, Arizona, USA. Dairy Goat Publishing Company, Scottsdale, Arizona, USA, p349.

Otsyina, H.R., Nguhiu-Mwangi, J., Mogoa, E.G.M., Mbuthia, Ogara, W.O. (2015) Prevalence of indigestible rumen foreign bodies in sheep and goats at Dagoretti and Kiserian Abattoirs, Kenya. Inter J Vet Sci 4(2), 75-80.

Remi-Adewunmi, B.D., Gyang, E.O., & Osinowo (2004). Abattoir survey of foreign body rumen impaction in small ruminants. Nigerian Vet. J., 25(2), 32-38.

Roman, T., & Hiwot, Y. (2010). Occurrence of rumen foreign bodies in sheep and goats slaughtered at the Addis Ababa Municipality. Ethiop Vet J, 14(1), 91-100.

Sangjin A., Woojin S., Yujin H., Sohwon B., Chea-Un C., Sooyoung C., Yeonsu O., Jong-Taek K. (2023) Ruminal impaction with an indigestible foreign body in long-tailed goral (Naemorhedus caudatus). Korean Journal of Veterinary Services, 46(2): 161-165.

Saulawa, M.A., Ukashatu, S., Garba, M.G., Magaji, A.A., Bello, M.B., & Magaji, A.S. (2012). Prevalence of indigestible substances in rumen and reticulum of small ruminants slaughtered at Katsina central abattoir, Katsina State, Nigeria. Sci J Pure Appl Sci, 1(1), 17-21.

Tesfaye, D., Yismaw, S., & Demissie, T. (2012). Ruminal and reticular foreign bodies in small ruminants slaughtered at Jimma Municipal abattoir, Southwestern Ethiopia. J Vet Adv, 2(8), 434-439.

Teshome, E., Abdela, N., & Hassan, A. (2017). Postmortem Study on Indigestible Foreign Bodies in Rumen and Reticulum of Ruminants Slaughtered at Asella Municipal Abattoir, Southeastern Ethiopia. Online Journal of Animal and Feed Research, 8(3), 2–6.

Vanitha, V., Nambi, A.P., Gowri, B., & Kavitha, S. (2010). Rumen impaction in cattle with indigestible foreign bodies in Chennai. Tamil Nadu J. Vet. Anim. Sci. Univ., 6(3): 138-140.

World Food Program (WFP), FAO, and FEWS NET Afghanistan, (2013), Afghanistan special report: Pre-harvest Assessment. Retrieved March 1, 2023 https://fews.net/sites/default/files/documents/reports/Afghanistan_SR_Joint_WFP_FAO_FEWS%20NET_Pre-Harvest_Assessment_05_2013.pdf