

The prevalence of plastic bag waste in the rumen of slaughtered livestock at three abattoirs in Nairobi Metropolis, Kenya and implications on livestock health

N C Lange, F Inganga, W Busienci, P Nguru, J Kiema and G Wahungu

National Environment Management Authority, P O Box 67839 - 00200, Nairobi, Kenya
clange@nema.go.ke

Abstract

This study presents the findings of a survey to investigate prevalence of plastic bags in the rumen of slaughtered livestock from three abattoirs notably; Dagoreti, Kiserian and Kenya Meat Commission abattoirs in Nairobi Metropolis, Kenya. Data was collected for 5 days by inspecting all slaughtered livestock for plastic bags in the rumens. A total of 2282 livestock were slaughtered from the abattoirs during the 5 days of inspection. Majority of the slaughtered animals were from Dagoreti (46.06%) followed by Kiserian (43.43%) and finally Kenya Meat Commission (10.52%). The greatest prevalence was recorded from livestock slaughtered at Kenya Meat Commission (30.42%) and the least prevalence of 3.14% from livestock slaughtered at Dagoreti. There were variations in the prevalence of plastic bags among livestock sourced from various parts of the country. The livestock from Matungulu area of Machakos County slaughtered at Kenya Meat Commission recorded the greatest prevalence of 57.81%. Other material recorded in the rumen include; nylon strings and synthetic hair. These findings confirm that plastic bags are ingested by livestock while feeding and the prevalence could be more than 50% of livestock in some parts of the country. The livestock infested with plastic bags present weak conditions that affect milk, beef production and generally the livestock industry. The ban of plastic bags in Kenya in 2017 should thus be upheld to safeguard the livestock industry and environment.

Key words: *environment, livestock industry, plastic bags ban, plastic bags ingestion*

Introduction

Plastic bags have over time emerged as a popular product world over. In 2005, it was estimated that between 500 billion to one trillion plastic bags were produced and used globally per annum (Bahri 2005). In Kenya, just like elsewhere in many other parts of the world, plastic production revolutionized plastic carrier bags production and use. According to UNEP (2005), because plastic bags for many years were given either free or inexpensive, they have been widely used in business as packaging material across the country. In 2005 it was estimated that leading supermarkets in Nairobi, gave an estimated 1 million plastic bags to customers (UNEP 2005). Further, a similar high number of plastic bags were estimated to be given out by the fast growing informal business sector (UNEP 2005). In January, 2005 it was reported that an estimated 8 million plastic bags were given out by supermarkets monthly and two times as many from the informal sector (UNEP 2005). In 2010, Aurah (2013) estimated that over 24 million plastic bags were used in Kenya monthly and half of this end up in municipal solid waste. The management of the plastic bags waste was however inefficient (Aurah 2013).

Owing to mass production, high supply and inefficient management of these plastic bags, over the years they continued to increase their present in the environment thereby becoming a major litter to the environment. By 2017, most environments particularly at the urban and peri-urban environments in Kenya were polluted with plastic bags. The plastic bags pollution come with many impacts to the environment, economy and human health. According to Aurah (2013), Plastic bag waste disposal is one of the most critical problems that threaten the sustainability of the natural resources, life support systems, social harmony, human rights, economic growth and people's participation in making decisions affecting lives. Elsewhere, a study by Meeker et al (2013) has reported that additives in plastics to which most people are exposed, such as phthalates, bisphenol A or polybrominated diphenyl ethers, may cause harm to human health by altering endocrine function or through other biological mechanisms. Over 100 species of seabirds are known to ingest plastic artefacts and/or become entangled with them (Laist 1997). Gregory (2009) reports that plastic waste could also create artificial hard grounds and cause problems, especially for burying creatures. By the beginning of 2017, most environments in Kenya were harbouring plastic bags and there were emerging postulations that they were being ingested by livestock while feeding. However, information on the plastic bags ingestion by livestock remain unavailable. Therefore, promote the understanding on patterns of plastic bags ingestion by livestock, the present study was therefore undertaken to investigate prevalence of plastic bags in

Materials and methods

The study was undertaken in July 2017 and involved visits to three abattoirs notably; Dagoreti, Kiserian and Kenya Meat Commission (KMC) abattoirs by a team of scientists from the National Environment Management Authority (NEMA) and with the aid of the abattoirs personnel inspecting all slaughtered animals rumens for plastic bags and recording information in presence and absence of plastic bags in the rumen. Dagoreti abattoir is in Kaimbu county, Kiserian in Kajiado county and Kenya Meat Commission in Machakos County. Data was collected continuously for 5 days at each abattoir included total number of animals slaughtered each day, number with plastic bags in rumen, colours of plastic bags in rumen and number of plastic bags pieces.

Results

Table 1 shows the total number of livestock slaughtered and the prevalence of plastic bags on the livestock. A total of 2282 livestock were slaughtered and inspected for plastics bags in the livestock rumens. The majority of the livestock were slaughtered from Dagoreti abattoir followed by Kiserian and the least from Kenya Meat Commission. The greatest prevalence of plastics bags in the livestock rumens was recorded from Kenya Meat Commission (KMC) and the least prevalence from livestock slaughtered at Dagoreti abattoir (Table 1).

Table 1. Total number of livestock slaughtered and prevalence for plastic bags at the various abattoirs sampled over five days.

Sampling session	Abattoir			Totals
	Kenya Meat Commission	Dagoreti	Kiserian	
Day 1	38	277	182	497
Day 2	21	272	160	453
Day 3	50	160	192	402
Day 4	64	205	193	462
Day 5	67	137	264	468
Totals	240	1051	991	2282
Prevalence of plastic bags	30.42%	3.14%	9.18%	

Prevalence of plastic bags in livestock rumens

Figures 1 – 3 shows the prevalence of plastic bags in rumens of slaughtered livestock at the various sampling days for each abattoir. The data showed that prevalence varied among the various days sampled for each abattoir. Kenya Meat Commission, presented the greatest variations with the highest prevalence recording 57.81% and the least prevalence recording 4.48%. This highest prevalence at Kenya Meat Commission was recorded from livestock sourced at Athi-river/Matungulu area of Machakos County. Dagoreti abattoir recorded prevalence ranging from 1.84% to 7.5% for the five days sampling was undertaken while Kiserian presented prevalence ranging from a minimum of 5.21% to a maximum of 10.99%.

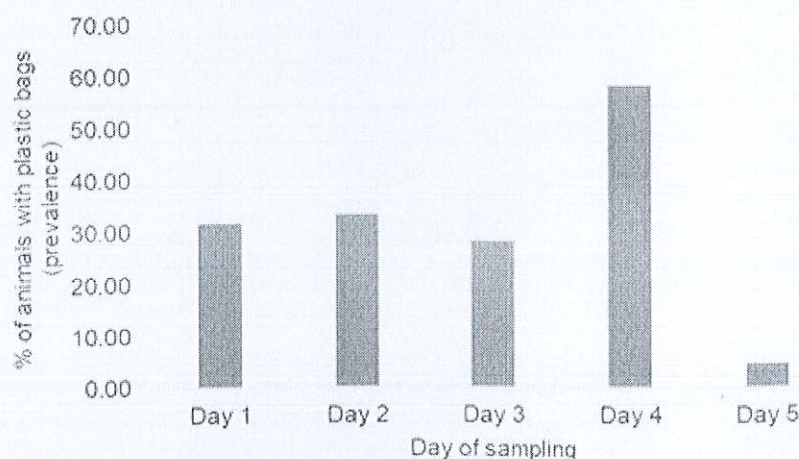


Figure 1. Prevalence of plastic in slaughtered livestock rumen at Kenya Meat Commission abattoir

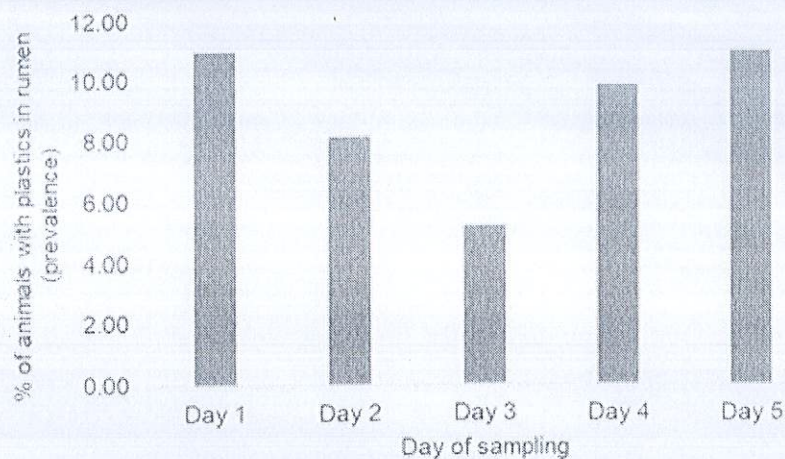


Figure 2. Prevalence of plastic in slaughtered livestock rumen at Kiserian abattoir

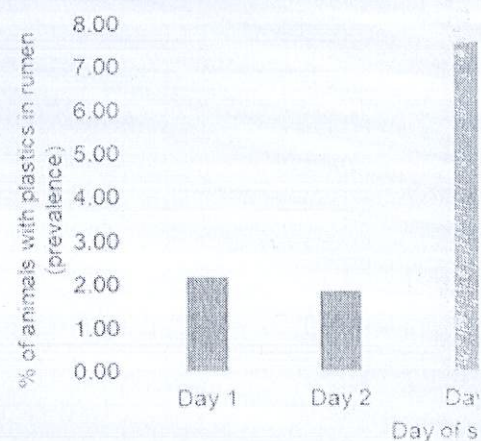


Figure 3. Prevalence of plastic in slaughtered livestock rumen at Dagoreti abattoir

Colour and number of pieces of plastic bags and other material recorded at livestock rumens.

The plastics bags recorded from the livestock rumens were of various colours comprising of black, green, yellow, white and red. There were also other material recorded which included polythene sacks, nylon clothes to synthetic hair. The black plastic bags were the most prevalent plastic bags recorded from the rumen contents. The livestock slaughtered from Kenya Meat Commission recorded the greatest amount of plastic pieces from the rumen. The plastic bags colours are obvious once recently ingested and at the first chamber of the animals stomach (Figure 4a). In the second chamber of the stomach, the plastic bags become intertwined (Figure 4b) while in the third chamber, they assume hard ball-like shapes (Figure 4c) and comprise of sharp edges that can injure the animal stomach walls.



Figure 4a. Plastic bags of various colours observed in the first chamber of the stomach of one of the animals slaughtered.



Figure 4b. Intertwined plastic bags observed in the second chamber of the stomach of one of the slaughtered animals.

Discussion

The present study findings confirm that plastic bags wastes are ingested by livestock while feeding at various parts of Kenya. According to Aurah (2013), poor solid waste management in Kenya allowed plastic bags litter the environment. These plastic bags once in the environment, they can persist for up to 1000 years without decomposing (Adane and Muleta 2011). By the beginning of 2017, plastic bags were widespread in many environments in Kenya on the ground and shrubs that serve as grazing fields for livestock. Most livestock graze or browse indiscriminately in the fields and as a result, they pick the plastic bags on the fields where the plastic bag wastes are mixed with the grass and other vegetation.

The study reported a prevalence of plastic bags in the slaughtered livestock rumens reaching up to over 50% (for cattle from Athi-river/Matungulu, Machakos county) suggesting that majority of livestock in some parts of Kenya are infected with plastic bags in the rumen. According to Nandwa (2014), the livestock that ingest these plastic bags suffer depression, reduced milk yield and bloat. Communications from the abattoirs personnel handling the livestock reported that the livestock infested with plastic bags physically appeared weak as compared to those

without the plastic bags in the rumen. The physically weak livestock are unattractive to livestock traders and thereby are bound to fetch low income while the bloated and depressed yield reduced milk lowering returns. Unconformed reports from Sekenani, Maasai Mara, Kenya show that of the nearly 40% of cattle and goats that had died during the drought, all had ingested significant numbers of plastic bags, sufficient to contribute to their premature deaths. Studies by Spear et al (1995) provided evidence that the higher the number of plastic particles ingested, the worse the physical condition (body weight) is in seabirds from the tropical Pacific. Upon ingestion, it is possible that these small fragments may present a physical hazard in a similar way to larger items of debris by clogging feeding appendages or the digestive system (Laist 1997; Derraik 2002). This scenario indicates the potential negative impact of plastic bags on the livestock industry. The livestock industry however contributes about 4.4% to Kenya's Growth Domestic Product (GDP) and thus the value of plastic bags waste management for safeguarding this vital economic sector in Kenya (Kenya Economic Survey 2018).

Apart from the plastic bags, the study recorded a range of other material from the rumens of the slaughtered livestock pointing to the need for attention for management of these wastes to safeguard the livestock industry too. The materials recorded in the livestock rumens that require attention include; nylon strings/ropes which are commonly used in markets and synthetic hair used by beauty shops.

Conclusion

- The study presents confirmation that plastic bags are ingested by livestock with the statistics of the number of the livestock that ingest plastics bags waste in some parts of Kenya likely to be more than 50% of the livestock.
- The ingested plastics bags have though implications on the livestock industry with many affected livestock presenting generally weak conditions, suffering boat and depression which affect milk and beef production.
- In conclusion given the challenges associated with plastic bags waste management, a legal framework on the ban of plastic bags in the country appears to be the most sustainable approach to the management of the plastic bags for safeguarding the important livestock industry and environment in Kenya.

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[Go to top](#)