

# Plastic Debris in the Digestive Tract of Sheep and Goats: An Increasing Environmental Contamination in Birjand, Iran

Arash Omid  · Hossein Naeemipoor ·  
Mahdi Hosseini

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**Abstract** A total of 230 goats and 185 sheep were evaluated in this cross-sectional observational study. After emptying the gastrointestinal tract, the size, location, adhesion and obstruction were examined. Twenty seven and half percent of sheep and 24 point 3 % of goats had foreign bodies. Most foreign bodies were plastic materials in sheep and goats. Forty percent of pregnant animals had foreign bodies. Drought and lack of adequate pastures in the past years have been a major cause of the swallowing of foreign objects by sheep and goats.

**Keywords** Gastrointestinal tract · Plastic · Sheep and goats


It is becoming increasingly difficult to ignore the deleterious effects of plastic debris on the environment and the animals living within. A large number of species is known to be harmed and even killed by plastic debris or other foreign bodies. This includes farm animals, wild animals, birds (Ryan 1987), marine (Derraik 2002), and even invertebrates (Thompson et al. 2004). Urban development is having a serious effect on livestock and wild animals grazing lands closer to cities which are becoming more and more polluted. Harmful effects from the ingestion of plastics include reduced food uptake, internal injury and death following the blockage of the intestinal tract or gastric enzyme secretion, the diminished feeding stimulus, the failure to absorb volatile fatty acids, the reduction of

the rate of animal fattening, the lower steroid hormone levels, and consequently delayed ovulation and reproductive failures (Azzarello and Van-Vleet 1987; Igbokwe et al. 2003). Sheep and goats are selective feeders compared to cattle; however, the ingestion of indigestible materials may occur during periods of nutritional deficiency (Igbokwe et al. 2003). The aim of this study was to determine the presence of foreign bodies in the stomachs of sheep and goats as a model of animals grazing near cities.

## Materials and Methods

This cross-sectional observational study was performed on 230 goats and 185 sheep slaughtered at the abattoir of Birjand district in South Khorasan province, Iran. The study was conducted for 3 months from July 2010 to September 2010. The animals were selected by systematic random sampling. The origins of goats and sheep slaughtered at the abattoir were from various cities of South Khorasan province. The age of the sheep and goats was determined the dental formula. Both the age and sex were recorded. After slaughter, the animals' stomach was carefully removed from the abdominal cavity, opened, and emptied. The rumen and reticulum were incised and thoroughly examined by visual inspection, palpation, and washing. The kind, size, number, adhesion, position, penetration and obstruction by foreign bodies were examined and recorded. All data was stored along with the necropsy findings. All statistical analysis was performed with the SPSS statistics package version 16.0. The  $\chi^2$  test was applied to test if there is any statistically significant association between risk factors such as sex, age, pregnancy and species. A difference with  $p < 0.05$  was considered to be significant.

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A. Omid  · H. Naeemipoor · M. Hosseini  
Department of Animal Sciences, Faculty of Agriculture,  
University of Birjand, P.O. Box: 91375-331, Birjand, Iran  
e-mail: arashomidi2@yahoo.com

## Results and Discussion

Among the 415 small ruminants, 185 sheep (44.6 %), and 230 goats (55.4 %) were examined for the presence of indigestible foreign bodies. Foreign bodies were found in the rumen of 107 (25.7 %) of the total small ruminants examined. Of these, 51 sheep (27.5 %) and 56 goats (24.3 %) had foreign bodies which were named as positive (Table 1). 33 male sheep (32 %) and 25 male goats (34 %), and 18 female sheep (21 %) and 31 female goats (19 %) were positive. Among the 240 female small ruminants, 11 sheep (13.4 %), and 11 goats (6 %) were pregnant. Of the pregnant animals, 5 sheep (45 %), and 4 goats (36 %) were positive. The types of foreign bodies retrieved from the rumen were plastic bags, textile, cotton, rope, glove, hair, and phytobezoar (Table 2). Plastic bags were the most common foreign bodies and were observed in 56 (52.33 %) of the positive cases. The main types of foreign bodies in sheep and goats slaughtered are shown in Table 3. In recent years, more and more plastic materials are being used by

humans (Zheng et al. 2005). Around 10% of the weight of the municipal waste comes from plastic materials (Barnes et al. 2009). Plastic particle pollution is an increasing phenomenon, and of concern in view of the possible damage caused to animal life. The ingestion of plastic was recorded in many species such as cows, buffalos, sheep, goats (Abebe and nuru 2011), sea birds (Ryan 1987), whales (Jacobsen et al. 2010), marine mammals, turtles (Gramentz 1988), fish, and crustaceans (Laist 1987). This study produced results that corroborate the findings of a great deal of the previous work in this field. Abebe and nuru (2011) examined the stomach contents of 384 sheep and goats in Ethiopia, Plastic materials were found in 59 % of the cases. The results of the present study indicate that the most common foreign bodies in sheep and goats in south Khorasan province are plastic bags. In this study, 25.7 % of slaughtered sheep had foreign bodies. In both species, the prevalence of plastic existence was higher in males than in females ( $p < 0.05$ ). Textile materials were equal in both sexes of each species. Plastic bags were more

**Table 1** Sex distribution and pregnancy condition of sheep and goats slaughtered in Birjand abattoir

Number (%) <sup>a</sup>	Male	Positive male	Female	Positive female	Pregnant	Positive pregnant	Total positives
Sheep (n = 185)	103	33 (32)	82	18 (21)	11	5 (45)	51 (27.5)
Goats (n = 230)	72	25 (34)	158	31 (19)	11	4 (36)	56 (24.3)
Sheep and goats (n = 415)	175	58 (33)	240	49 (20)	22	9 (40)	107 (25.7)

<sup>a</sup> % of animals harboring foreign bodies in their stomach

**Table 2** Frequency of rumen foreign bodies in sheep and goats slaughtered in Birjand abattoir

Animal species (positive)	Frequency of occurrence (% <sup>a</sup> )										
	Plastic	Textile	Cotton	Rope	Plastic–cotton	Textile–cotton	Plastic–glove	Plastic–textile	Plastic–textile–cotton	Hair ball	Phytobezoar
Sheep (n = 51)	26 (50.98)	1 (1.96)	7 (13.72)	1 (1.96)	6 (11.76)	1 (1.96)	1 (1.96)	2 (3.92)	2 (3.92)	1 (1.96)	3 (5.88)
Goats (n = 56)	30 (53.57)	3 (5.35)	3 (5.35)	0 (0)	3 (5.35)	1 (1.78)	1 (1.78)	0 (0)	4 (7.14)	3 (5.35)	8 (14.28)
Total (n = 107)	56 (52.33)	4 (3.7)	10 (9.3)	1 (0.93)	9 (8.4)	2 (1.8)	2 (1.8)	2 (1.8)	6 (5.6)	4 (3.7)	11 (10)

<sup>a</sup> % of animals harboring foreign bodies in their stomach

**Table 3** Main types of foreign bodies in sheep and goats slaughtered in Birjand abattoir

Types of foreign bodies	Positive sheep			Positive goats		
	Sex			Sex		
	Number (% <sup>a</sup> )			Number (% <sup>a</sup> )		
	Male	Female	Total	Male	Female	Total
Plastic	21 (61.7)	7 (41.1)	28 (54)	18 (72)	13 (41)	31 (55.3)
Textile	6 (17.6)	3 (17.6)	9 (17.6)	3 (12)	4 (12.9)	7 (12.5)
Plastic and textile	6 (17.6)	4 (23.5)	10 (19.6)	2 (8)	5 (16.1)	7 (12.5)
Hair ball	1 (2.9)	0 (0)	1 (1.9)	0 (0)	3 (9)	3 (5.3)
Phytobezoar	0 (0)	3 (17.6)	3 (5.8)	2 (8)	6 (19)	8 (14.2)
Total	34 (100)	17 (100)	51 (100)	25 (100)	31 (100)	56 (100)

<sup>a</sup> % of animals harboring foreign bodies in their stomach

**Table 4** Age distribution of sheep and goats slaughtered in Birjand abattoir

Types of foreign bodies	Positive sheep					Positive goats						
	Number (%) <sup>a</sup>					Number (%) <sup>a</sup>						
	≤1	1–2	2–3	3–4	≥4	Total	≤1	1–2	2–3	3–4	≥4	Total
Plastic	19 (63.3)	1 (12.5)	0 (0)	2 (50)	7 (87.5)	29 (54.7)	0 (0)	6 (60)	10 (76.9)	10 (55.5)	5 (38.4)	31 (55.3)
Textile	6 (20)	2 (25)	0 (0)	1 (25)	0 (0)	9 (16.9)	0 (0)	3 (30)	2 (15.3)	1 (5.5)	1 (7.6)	7 (12.5)
Plastic and textile	5 (16.6)	4 (50)	1 (33.3)	0 (0)	1 (12.5)	11 (20.7)	1 (50)	1 (10)	0 (0)	3 (16.6)	2 (15.3)	7 (12.5)
Hair ball	0 (0)	1 (12.5)	0 (0)	0 (0)	0 (0)	1 (1.8)	1 (50)	0 (0)	0 (0)	1 (5.5)	1 (7.6)	3 (5.3)
Phytobezoar	0 (0)	0 (0)	2 (66.6)	1 (25)	0 (0)	3 (5.6)	0 (0)	0 (0)	1 (7)	3 (16.6)	4 (30.7)	8 (14.2)
Total	30 (100)	8 (100)	3 (100)	4 (100)	8 (100)	53 (100)	2 (100)	10 (100)	13 (100)	18 (100)	13 (100)	56 (100)

<sup>a</sup> % of animals harboring foreign bodies in their stomach

frequently encountered in adult sheep older than 4 years, and in goats between 2 and 3 years of age (Table 4). Surprisingly, no metal foreign bodies were found in this study. There are several possible explanations for this result. It may be related to feeding selection behavior of sheep and goats (Igbokwe et al. 2003) or inexistence of industrial pollutions in their grazing lands. In young animals (<2 years), sheep had more foreign bodies than goats, especially plastic. Pastures are the main source of small ruminant’s food in south Khorasan province. Clean up of the environment will reduce foreign body-pica syndrome in animal life. Limitations of feeding during the past long dry season increased the likelihood of ingestion of foreign bodies. This is also associated with nutritional deficiencies, specifically of minerals and vitamins origin. The incidence of plastic materials ingestion can be extremely high in some species, because they mistake it for their food (Gregory 2009). These results can be generalized to wild-life animals. The accumulation of plastics in natural habitats causes physical problems for wildlife resulting from ingestion or entanglement in plastic. Further research should be done to investigate the prevalence of foreign bodies, especially plastics in gastrointestinal tract of wild animals such as deer, rams, and some wild birds. Biodegradation of plastic wastes is very important (Zheng et al. 2005). Broader research is also required for the production of easily biodegradable materials, which can be biodegraded by microorganisms.

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