

**REVIEW ARTICLE**

**RUMEN IMPACTION WITH FOREIGN INDIGESTIBLE MATERIALS  
IN DOMESTIC RUMINANTS IN NIGERIA: A REVIEW**

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**Abstract**

Rumen impaction due to foreign indigestible materials has become one of the major gastro-intestinal disorders in ruminant livestock causing severe loss of meat and milk production and high mortality rates. Ingested foreign bodies affect the health of animals and cause economic loss to the owner. Among other factors, the current widespread use of polythene and other non-biodegradable materials with improper waste disposal is a major predisposing factor to the development of rumen impaction. In this paper, the Nigerian situation with regard to the prevalence, reported fatalities, composition of recovered foreign materials, risk factors and clinical signs of foreign body rumen impaction are reviewed, including the clinical management approaches to the condition, the hemato-biochemical, trace element profile and pathology of the rumen in affected animals. The review also provides information on the waste disposal situation in Nigeria as it relates to the development of this condition with emphasis on its economic implications and the preventive strategies to counteract the problem of rumen impaction.

**Introduction**

The indigenous ruminant livestock industry in Nigeria represents a very important national resource, contributing immensely to national health and wealth through the supply of dietary

protein and industrial raw materials (Alayande and Olorede, 1999). However, efforts at improving livestock productivity in the tropics, and particularly in Nigeria continue to be unrewarding because of near ubiquitous shortage of good quality livestock feeds, rapidly

diminishing forage and poor husbandry practices (ILCA, 1986). A high proportion of the livestock population are reared under the extensive system of animal husbandry characterized by uncontrolled movement of animals over a large expanse of land, grossly inadequate feed intake, poor nutrition and high disease prevalence. In West Africa, including Nigeria, the domestic ruminant population consists of different breeds of domestic cattle, sheep and goats. Sheep and goats are reared traditionally at subsistence level and in many cases, are usually left to scavenge and cater for their own nourishment (Adeloye, 1985).

Rumen impaction has been described as a condition resulting from the accumulation of the indigestible materials in the rumen which interferes with the flow of ingesta, leading to distension of the rumen and passing of scanty or no feces (Abdullahi *et al.*, 1984). Gastro-intestinal foreign bodies are currently one of the most common surgical emergencies in veterinary medicine (Tesfaye *et al.*, 2012a). Ingestion of foreign body by cattle was reported to be a condition of great economic importance that causes severe loss of production and high mortality rates (Radostits *et al.*, 2000). On the other hand, sheep and goats are highly selective feeders and ingest significantly less amount of foreign bodies as compared to cattle (Hailat *et al.*, 1996). However, the ingestion of indigestible materials by these animals may also occur during period of food scarcity (Igbokwe *et al.*, 2003).

Ingestion of indigestible materials leading to ruminal impaction is believed to be peculiar to the sub-Saharan geographical zone of the northern part of Nigeria because of its heavy livestock population and poor fodder resources (Igbokwe *et al.*, 2003; Remi-Adewumi *et al.*, 2004; Mohammed and Mohammad, 2007).

However, a phenomenal increase in the incidence of foreign body rumen impaction relative to increase in demand and use of polythene materials in urban and rural areas has also been reported in the southern geographic zone (Akinrinmade and Akinrinde, 2012a; Akinrinmade and Akinrinde, 2012b).

### Prevalence of Foreign Body Rumen Impaction

Several workers have reported the prevalence of foreign body rumen impaction in ruminants in different parts of Nigeria and in other developing countries. Rumen foreign body occurred less frequently in goats than in sheep due to the selective nature of goats while grazing (Remi-Adewunmi *et al.*, 2004; Murray, 1980). Reports in small ruminants appear to be much more than those in cattle as noted previously.

#### Sheep and Goats

An abattoir survey carried out by Remi-Adewunmi *et al.* (2004), in Zaria, Northern Nigeria, revealed that, of the 800 small ruminants slaughtered over a 3-month period, 77% (144 out of 187) of sheep and 20.7% (127 out of 613) of goats had indigestible garbage in their rumen. Plastic bag was found to be the most prevalent material in 85% of the cases. In a similar abattoir survey carried out in goats, in Ibadan, sub-tropic humid zone, over a period of four months, Akinrinmade and Akinrinde (2012a), reported a lower prevalence of 9.61% in goats. In both studies, sex and age were found to have significant interaction with rumen impaction, with the condition being more prevalent in female animals than in males, while older animals exhibited higher prevalence than younger ones. Akinrinmade and Akinrinde (2012a), suggested that the difference in prevalence rates from their study and that of

Remi-Adewumi *et al.* (2004), could be due to differences in ecological/geographic zone and period the animals were studied/examined (October-December compared to May-June) including the sample size (127 out of 613 for Remi-Adewumi *et al.* as against 432 out of 4488 for the study by Akinrinmade and Akinrinde). Furthermore, Igbokwe *et al.* (2003), studied 540 sheep in Maiduguri, a town in the semi-arid region of Nigeria, and reported a prevalence of 19.3% in sheep slaughtered at the Maiduguri abattoir. A variety of indigestible foreign materials including polythene/cellophane materials, ropes, dry seeds, caked sand, metallic objects, paper, fiber and hair balls were recovered, with polythene/cellophane materials occurring in 81.6% of the sheep. Again, more females were reported to be affected than males (Igbokwe *et al.*, 2003).

Abattoir surveys of rumen impaction in small ruminants constitute the major reports of prevalence in Nigeria. Surveys conducted in Veterinary clinics are available elsewhere. Hailat *et al.* (1996), in a study of foreign bodies in 1453 Awassi sheep presented to a Veterinary Clinic in Jordan during a 27 month period, observed that of the 1453 sheep, 130 (20.64%) had rumen impaction by plastic, while also reporting that plastics were the most common materials recovered. Also in Jordan, a study by Hailat *et al.* (1998), in goats revealed that out of 347 rumens examined in the summer of 1996, 39 (11%); 10/136 (7%) rumens at Ajloun and 29/311 (7%) at Irbid slaughterhouses contained plastics. Out of the 888 goats brought to the Veterinary Health Centre (VHC) from January 1993 to September 1997 for treatment of different conditions, 32 (3.6%) had plastic impaction and were treated by rumenotomy. It is noteworthy, however, that a profound similarity in rumen impaction reported within and outside Nigeria in sheep and goats is in the

nature of impacted materials of which polythene materials predominate.

#### Cattle

Most reports of foreign body rumen impaction in Nigerian cattle have focused on case reports of fatalities rather than surveys on the prevalence. Mohammed and Muhammad (2007), in a retrospective study of 45 cattle necropsied over a five-year period (2000-2004) in Zaria, Nigeria, reported that 23 (51.2%) cattle had masses of non-degradable polythene materials in their rumen. A further 40.3% of 67 slaughtered cattle in a meat laboratory within the same period had rumen impaction due to ingestion of polythene materials (Mohammed and Muhammad, 2007). However, Akinrinmade and Akinrinde (2012b), reported an overall prevalence of 10.77% in 3031 cattle slaughtered over 3 months (March-May) at the Municipal Abattoir in Ibadan, Southwestern Nigeria.

Recent reports by Tesfaye *et al.* (2012a), in Ethiopia showed that out of a total of 384 cattle examined, 92 (23.9%) were found to have different types of foreign bodies in their rumen and/or reticulum. The study was conducted at the Hirna municipal abattoir in Ethiopia from November 2011 to March 2012.

It could be inferred from the different reports that rumen impaction with foreign indigestible materials is a widespread and common problem, very prevalent in ruminants in Nigeria and in countries with similar geographic and socio-economic attributes. The preponderance of polythene materials among indigestible materials discovered indicates a general waste disposal problem that must be urgently addressed in our municipalities.

### Fatalities Due to Foreign Body Rumen Impaction

Case reports of animal mortalities due to foreign body rumen impaction have been documented in cattle, sheep and goats (Akinrinmade *et al.*, 1988, Otesile and Akpokodje, 1991; Elsa *et al.*, 1995; Mohammed and Mohammad, 2007). Deaths of animals due to foreign body impaction may occur acutely as in those associated with the occurrence of acute bloat due to blockage of the rumino-reticular orifice and subsequent accumulation of gas from rumen fermentation. In some cases, the animals are lost if management of the bloat is not effected promptly (Elsa *et al.*, 1995).

### Composition of Foreign Body Materials

In Nigeria, several reports on the condition of foreign body rumen impaction in cattle, sheep and goats indicated the presence of indigestible, non-biodegradable materials, including Plastic/polythene materials, pieces of cloth and leather, ropes, shreds of twine and ropes, hairballs, paper, dry seeds, caked sand, and sometimes, metallic objects (Abdullahi and Mohammed, 1981; Abdullahi *et al.*, 1984; Otesile and Akpokodje, 1991; Igbokwe *et al.*, 2003; Remi-Adewumi *et al.*, 2004; Mohammed and Mohammad, 2007; Akinrinmade and Akinrinde, 2012a, Akinrinmade and Akinrinde, 2012b). This is also similar to reports from elsewhere outside Nigeria (Hailat *et al.*, 1996; Tiruneh and Yesuwork, 2010; Fromsa and Mohammed, 2011). Plastic/polythene materials have reportedly been the most common materials recovered from the affected animals. Similar impacted materials have been discovered in affected animals in other countries. Plastics, rope, hair, paper, leather were recovered from the rumen of animals studied in Addis Ababa, Ethiopia (Tiruneh and Yesuwork, 2010). At Luha export abattoir,

Ethiopia, Polyethylene plastic bags, hairballs and leather were the frequently encountered impacted materials (Fromsa and Mohammed, 2011).

The weights of impacted masses of foreign materials recovered from ruminants usually vary from 0.2 to 6.0kg in small ruminants (Remi-Adewumi *et al.*, 2004; Igbokwe *et al.*, 2003). In cattle, the weights of impacted masses were between 2.5 and 4.3kg (Mohammed and Muhammad, 2007). Elsewhere, in an exceptional case of Kankrej cattle being managed surgically for rumen impaction, masses weighing between 15 and 37kg were recovered from the animals (Suthar *et al.*, 2011).

### Risk Factors for the Development of Foreign Body Rumen Impaction

Foreign body rumen impaction has been associated with a variety of factors. It has been reported that ingestion of foreign bodies is associated with shortage of forage and increased pollution of grazing land with indigestible foreign bodies (Abdullahi *et al.*, 1984; Otesile and Akpokodje, 1991; Igbokwe *et al.*, 2003; Remi-Adewumi *et al.*, 2004). Similar findings were also reported by Akinrinmade and Akinrinde (2012a), who suggested that foreign body rumen impaction in the goat was mainly associated with declining fodder resources, with nutritional inadequacy in terms of quality and quantity appearing to be a common denominator. The latter authors also highlighted the environmental hazard posed to animals by improper waste disposal and the urgent need for proper legislation.

The challenge of urbanization with improper waste disposal poses great risk to animals that are usually left to roam and find their own food. Pasture and supplementary concentrate feed for

intensive livestock management are limited and expensive. As a result, most livestock farmers adopt free-range management system in the urban and semi-urban communities where their animals, mostly sheep and goats, scavenge for food, often going into refuse dumps, which are around the towns (Igbokwe *et al.*, 2003).

In Nigeria, the prevalence of rumen foreign bodies was reported to be higher in animals originating from urban settings than from rural areas indicating that management of animals plays a crucial role for the occurrence of foreign bodies (Igbokwe *et al.*, 2003). In urban areas, the land available for grazing is generally smaller and animals that are kept under extensive system in urban areas graze the refuse dumps composed of household and factory wastes (Tesfaye *et al.*, 2012). Polythene plastic materials constitute the most frequently encountered foreign material in cases of rumen impaction. Such polythene materials were usually discarded in the environment from packages for food, water and household wares (Igbokwe *et al.*, 2003).

The shortage of feed during the long dry season increase the likelihood of the ingestion of plastic foreign bodies. Conditions prevailing in the dry season are associated, not only with a shortage of feed but also of minerals and vitamins (Tirneh and Yesuwork, 2010). Water deprivation, combined with shortage of feed during the dry season in arid/semi-arid areas of Northern Nigeria has been identified as a major risk factor for the ingestion of foreign bodies (Sanni *et al.*, 1998). It is possible that ruminants ingest foreign bodies because of shortage of feeds and, perhaps specifically, shortage of minerals and vitamins. In goats, insufficient supply of sodium chloride may lead to depraved appetite and chewing of soil and debris (Haenlein, 1994). Copper, phosphorus and

cobalt-deficient cows have also been shown to eat foreign bodies (Spaais, 1975).

Abnormal appetite or pica, predisposing animals to foreign body impaction, has been associated with phosphorus deficiency (Fraser and Broom, 1990). However, pica may sometimes not be associated with phosphorus deficiency, but rather related to poor nutrition, anemia, iron and cobalt deficiencies and other unknown causes (Fraser and Broom, 1990; Radostits *et al.*, 1994). Deficiency of phosphorus is regarded as the most widespread and economically important of all the mineral deficiencies affecting grazing livestock (McDonald *et al.*, 1998). Most livestock grazing areas of tropical countries contain soils and plants low in phosphorus (McDowell, 1992). Sowande *et al.* (2008), reported a significant decrease in phosphorus concentration in the blood of WAD goats and sheep grazing natural pastures in Southwest Nigeria and ascribed this to climatic fluctuations. High incidence of foreign body rumen impaction in sheep and goats during the dry season reported by Remi-Adewumi *et al.* (2004), also supported seasonal variation in phosphorus levels. Significantly low phosphorus levels obtained in studies of goats with foreign body impaction may indicate its probable role in the etio-pathogenesis of foreign body impaction and depraved appetite related disorders (Akinrinmade and Akinrinde, 2012b).

The impact of age and sex as risk factors for foreign body rumen impaction has also been evaluated in several studies. Tirneh and Yesuwork (2010), reported that animals aged between 3 and 4 years were found frequently to have rumen foreign bodies. Animals in this age group had more foreign bodies than the younger ones because of gradual accumulation of these types of foreign bodies in the rumen. Sanni *et*

*al.* (1998), also suggested that the higher prevalence of foreign body rumen impaction in older animals, suggest that the process of formation is slow, gradual and progressive. Reports of higher prevalence of foreign body rumen impaction in older animals have also been observed in other studies (Akinrinmade and Akinrinde, 2012a, 2012b; Remi-Adewumi *et al.*, 2004; Fromsa and Mohammed, 2011). Specifically, out of an overall prevalence (9.61%) of rumen impaction in goats (Akinrinmade and Akinrinde, 2012a), 4.09% was in goats above 3 years of age; 2.18% in goats between 2 and 3 years; 1.92% in goats between 1 and 2 years, while those below 1 year had a prevalence of 1.42%. In the same study, female animals accounted for 6.23% out of an overall prevalence of 9.61%, while male goats had 3.38% prevalence rate.

Generally, rumen impaction with foreign indigestible materials occurs more frequently in females than the males. This is thought to be due to the fact that the females might have increased appetite due to the nutritional demands of estrus, pregnancy and lactation.

#### **Mechanism/Etiopathogenesis of Foreign Body Rumen Impaction**

Extensively managed small ruminants are usually seen on roadsides or refuse dumps eating away the plastic materials and their contents in search of food. The ingested material e.g. polythene, hinders the process of fermentation and mixing of contents in the rumen leading to indigestion. The plastic materials cannot be digested or passed as such through faeces by an animal. The accumulation of the indigestible materials in the rumen interferes with the flow of ingesta leading to distension of the rumen and passing of scanty or no feces (Abdullahi *et al.*, 1984). They,

therefore stay in the gut causing weight loss, pain and death. They also obstruct the orifice between reticulum and omasum and if not removed through surgery, polythene may become fatal.

Lambs often lick their hair coat especially after early weaning (Fraser and Broom, 1990), thereby ingesting hair, which eventually form hair balls or trichobezoars (Radostits *et al.*, 1994). In young animals, caked sand and paper balls in the rumen might be associated with licking of sandy materials and eating of papers, respectively. Fiber balls or phytobezoars have been reported to be common in areas where fibrous feeds form a large part of the diet (Radostits *et al.*, 1994) like in the sahel region during the dry season. Other materials such as metallic objects, dry seeds and ropes might be indiscriminately ingested when imbedded in other available palatable foods.

#### **Clinical Signs of Rumen Impaction**

Rumen impaction by foreign bodies is more often asymptomatic in nature and only diagnosed in live animals if the material has accumulated in large amounts. As such, most cases are usually discovered at necropsy or during slaughter of animals at abattoirs (Abdullahi *et al.*, 1984; Remi-Adewumi *et al.*, 2004; Akinrinmade and Akinrinde 2012a, b). Very acute cases have resulted in fatalities with little or no clinical signs. The presence of these foreign materials in the rumen and reticulum also hampers the absorption of volatile fatty acids and consequently reduces the rate of weight gain (Igbokwe *et al.*, 2003).

The most common symptoms observed in the affected animal include bloat and may be exhibited by the abnormal bulging of the paralumbar fossa on the left side of the abdominal wall. Acute bloat associated with

rumen impaction may be due to the complete obstruction of the rumino-reticular orifice, preventing ingesta from being moved to the next compartment with accumulation of the fermented gas in the rumen. Other clinical symptoms may include depression, complete or partial anorexia followed by loss of weight, reduction of milk yield, and suspended rumination. Milk yield and weight reduction in the affected animals are variable according to the stage of lactation, quantities of foreign bodies ingested and severity of the bloat (Ramaswamy and Sharma, 2011).

### **Haematological Profile of Animals with Foreign Body Rumen Impaction**

The relatively insidious nature of the development of rumen impaction more often precludes the establishment of obvious clinical signs. Previous studies have shown that changes in hematological and biochemical indices are pointers to various disease conditions, even at sub-clinical levels and have been used to provide diagnostic and prognostic aids in some disease conditions (Jain, 1986; Taiwo and Anosa, 1988).

In West African Dwarf goats with impaction (Akinrinmade and Akinrinde, 2012c), although packed cell volume, erythrocyte counts, hemoglobin values and white blood cell counts were within the normal range, the values were significantly lower than those of goats without foreign body impaction. The findings were attributed to gastrointestinal disease and malnutrition as suggested in earlier reports (Akinrinmade *et al.*, 1988; Otesile and Akpokodje, 1991; Remi-Adewumi *et al.*, 2004), including an overwhelmed ruminal function by the continuous ingestion and accumulation of foreign materials. Abdullahi *et al.* (1984), also reported that the haematological parameters of

sheep with rumen impaction were within the normal range.

In a similar study in cattle by Akinrinmade and Akinrinde (2012d), significant decreases in mean values of PCV, total erythrocyte count and hemoglobin concentration were reported in cattle with foreign body rumen impaction. The finding corroborates earlier reports in cattle with foreign body rumen impaction (Vanitha *et al.*, 2010; Mayer *et al.*, 1992). Studies on rumen pathology in Sudanese sheep with rumen impaction showed high white blood cell (WBC) counts and low RBC count, PCV and Hb concentration (Bakhiet, 2008).

### **Biochemical Profile of Animals With Foreign Body Rumen Impaction**

Igbokwe *et al.* (2003), reported hypoproteinaemia, hypoalbuminaemia, hyponatraemia and hypochloridaemia in some clinical cases of foreign body impaction in sheep and these are thought to be due to decreased availability of dietary protein and salt. Hypoproteinemia, hypocalcemia and hypophosphatemia have also been documented in affected cattle (Akinrinmade and Akinrinde, 2012c).

Hypoglycemia in animals with rumen impaction had been earlier reported by Llewellyn (1976), in Friesian cows and might be due to inadequate intake of feed (Ramakrishna, 1994). Akinrinmade and Akinrinde (2012c) reported that the mean serum glucose value in cattle with foreign body impaction was significantly lower than in animals without foreign body impaction. Low level of glucose in animals with foreign body rumen impaction was ascribed to high levels of free fatty acids and cholesterol associated with reduced energy intake, and decreased glucose synthesis (McDowell, 1992). However, Igbokwe *et al.* (2003), reported

hyperglycemia in sheep with foreign body rumen impaction in response to systemic stress (Duncan and Prasse, 1977).

Zilva and Pannall (1984), suggested that hypoalbuminaemia is often accompanied by hypocalcaemia because plasma albumin binds  $Ca^{2+}$ . However, other causes of hypocalcaemia include dietary deficiency and failure of calcium absorption due to reduced ruminal motility (Vanitha *et al.*, 2010).

### Trace Element Profile of Animals with Foreign Body Rumen Impaction

Trace element assessment is normally done to determine the presence or prevalence of nutrient deficiencies and evaluate the efficacy of dietary supplementation or to compare available supplement with new ones. Physiological functions and economically important aspects of performance and health of animals can be affected by trace element deficiencies even before clinical signs are evident (Kincaid, 1999).

The precise role of individual trace element in the etio-pathogenesis of foreign body rumen impaction has not been ascertained. Akinrinmade and Akinrinde (2012c) reported significant decreases in the mean values of copper, zinc, manganese, selenium and cobalt in cattle with foreign body impaction. It is also possible that the low levels of these trace element may have been caused by the nutritional deficiencies which predispose these animals to ingestion of foreign materials in the first instance. It is however, also reasonable to suggest that the presence of rumen foreign bodies may cause reduction in circulating levels of these elements. Because ruminant diets are usually high in fiber and considerable digestion of fiber occurs via microbial fermentation in the

rumen, this process is hampered by the presence of foreign body materials. The association of minerals with fiber fractions in feedstuff (Whitehead *et al.*, 1985) and/or binding of minerals to indigestible constituents may also alter bioavailability of some trace minerals in ruminants (Kabaija and Smith, 1988). In essence, the effects of malnutrition and foreign body rumen impaction on biochemical and trace element profiles cannot be easily separated and needs further investigation.

### Pathology of the Rumen in Relation to Impaction

The main pathological lesions encountered in sheep with plastics in their rumens are inflammation of the rumen, erosion and hyperplasia (Hailat *et al.*, 1995). Pathological hyperplasia may be a precursor to neoplastic proliferation (Robbins *et al.*, 1984). It is, however, unclear whether these hyperplastic changes were due to the mechanical irritation induced by the ingested plastic or to some chemical substances released from the plastic irritating the proliferation of the ruminal epithelium (Hailat *et al.*, 1998).

Bakhiet (2008), provided considerable details of the nature of pathological changes in affected sheep as inflammation of the rumen, haemorrhage, and presence of foreign body on gross examination. Microscopic examination showed congestion, haemorrhage and stunting of the papillae. Thickening of the ruminant wall, erosion, ulceration and scar formation were seen in the rumen. Other lesions concerned with foreign body included hydropic degeneration, submucosal oedema with dilated lymphatics in the sub mucosa. Focal hyperplasia of the ruminal epithelium in different regions was also prominent (Bakhiet, 2008). The sloughing, stunting, erosions,

inflammatory response, and the hyperplasia are most likely to be due to the pressure on the wall of the rumen caused by the foreign body leaving the wall exposed to secondary infection which resulted in both inflammatory and hyperplastic changes (Bakhiet, 2008).

### Diagnosis of Foreign Body Rumen Impaction

Field diagnosis of the presence of ruminal foreign bodies is naturally a difficult one, except where exploratory surgery is involved. The diagnosis of rumen impaction based on abdominal ballotment in small ruminants may be inconclusive (Abdullahi *et al.*, 1984) because masses of impacted foreign materials may be mistaken for a fetus during ballotment (Akinrinmade *et al.*, 1988; Garba and Abdullahi, 1995).

Affected animals with the clinical condition often present with signs indicative of primary rumen dysfunction. In making a diagnosis of rumen impaction, appropriate history including duration of observed problems, appetite, number of animals affected in the herd, type of feed, use of additives/mineral supplements, recent changes in diet and husbandry practices should be obtained from the owner (Abdullahi *et al.*, 1984). This is often combined with thorough physical examination including determination of rectal temperature, respiratory and pulse rates, examination of mucous membranes, systematic examination of the gastro-intestinal tract, rumen motility through the abdominal wall of the left flank, symmetry of the abdomen and rectal palpation. Wither test by pinching the withers to cause depression of back and eliciting grunt is an effective diagnostic tool usually heard 2 to 3 seconds before primary ruminal contraction can be felt through the left flank (William, 1955).

Boodur *et al.* (2010), reported that the main diagnostic sign noticed was bilateral sunken flank region with doughy or hard impaction of rumen (Kohli *et al.*, 1998). Boodur *et al.* (2010), reported that alkaline pH can be important diagnostic tool in field conditions for early detection of plastic indigestion cases. Tripathi *et al.* (2010), reported low pitched reticular sounds audible on auscultation at 7th to 8th rib on left side with severe distention in left para lumbar fossa and slight distention in right flank.

The most reliable non-invasive diagnostic method in cattle is by rectal palpation (Abdullahi *et al.*, 1984). This technique has been described by Grymer and Ames (1981), as very useful in the diagnosis of diseases of the digestive tract, particularly those due to primary rumen dysfunctions. Definitive diagnosis of rumen impaction has been achieved through exploratory rumentomy (Akinrinmade *et al.*, 1988; Elsa *et al.*, 1995; Igbokwe and Kolo, 2005). Radiography (Akinrinmade *et al.*, 1988) and Ultrasonography (Arthar *et al.*, 2010) have proved to be very reliable tools in the diagnosis of foreign body impaction.

### Clinical Management of Rumen Impaction

Emptying the rumen by rumenotomy is considered as the only method for the management of foreign body rumen impaction (Boodur *et al.*, 2010). Suthal *et al.*, 2011 also regarded surgery as the only effective method of treatment of plastic foreign bodies but that an early diagnosis is essential for a favorable outcome. Surgical removal of foreign body resulted in progressive increase in body weight attributed to increase in appetite (Igbokwe and Kolo, 2005). Rumenotomy along with transplantation of fresh ruminal cud have been

found satisfactory in restoration of normal ruminal function (Suthal *et al.*, 2011) in the field for the treatment of chronic impaction due to plastics/polythene foreign bodies. Post-operatively, ample amount of fluid therapy along with antibiotics, analgesics and antihistaminics should be administered. Pre-biotic oral administration has proven to be rewarding in reviving normal fermentation process in the rumen following surgery (Suthal *et al.*, 2011). Restoration of ruminal ecology and function after surgical manipulations ensure maximum benefit from surgery (Purohit, 2010).

Clinical cases of rumen impaction due to dietary error were successfully managed in bovines using the prokinetic effect of metoclopramide in combination with fluids and vitamin B complex injection (Vijayalakshmi *et al.*, 2010). An effective prokinetic drug induces forestomach motility in a co-ordinated sequence of contractions and relaxation of sphincter. Metoclopramide increases the rate of ruminal contraction and might be beneficial in rumen hypomotility associated with foreign body rumen impaction (Radostits *et al.*, 2009). El-Khodery and Sato (2008) suggested the use of metoclopramide at 0.3mg/kg to produce mild and transient prokinetic effect.

### **Economic Implications of Rumen Impaction**

Rumen impaction is economically important because it causes high mortality rate even though many cases go unrecognized. Among the clinically affected animals, about 25% develop incurable condition while the other 75% can be expected to recover completely with conservative treatment or routine surgical intervention (Radostits *et al.*, 1994). Diseases of the rumen and reticulum are of great economic importance because of severe losses on the

productivity of the animals, sometimes leading to death of the animals.

Reduction in milk yield may be a consequence of rumen impaction. As noted earlier, milk and weight reduction in the affected animals are variable according to the stage of lactation, quantities of foreign bodies ingested and severity of the bloat (Ramaswamy and Sharma, 2011).

In monetary terms, a recent survey by Remi-Adewumi *et al.* (2011), concluded that an estimated annual financial loss of over thirty-eight billion naira (₦38,315,689,716 or \$247,197,997) due to rumen impaction is incurred in Northern Nigeria alone. These were reported to be estimates from surgical treatment (₦8,005,270,451 or \$51,646,906), poor live animals prices (₦1,574,094,119= \$10,155,446), poor carcass weight prices (₦3,521,755,346 or \$22,721,002), premature culling (₦22,969,286,052 or \$148,188,942) and mortalities (₦2,245,283,748 or \$14,485,701).

In Jordan, it was estimated that losses in sheep production and health, due to plastic impaction was around fifteen million dollars in 1993 (Al-Dwery, 1994).

It is likely that foreign body impaction would be a growing problem for grazing animals in Nigeria, as grazing lands become more and more polluted with plastics and other non-biodegradable materials and therefore more economic losses.

### **Prevention of Foreign Body Rumen Impaction**

In view of the prevailing environmental issues that pre-dispose animals to the ingestion of indigestible foreign materials, it is essential that

preventive measures be taken to at least minimize the ever-increasing incidence of the condition. A variety of measures have been advocated for prevention by several workers as follows:

1. Government should enforce strict regulations on waste disposal with animal confinement in towns and cities (Remi-Adewumi *et al.*, 2011; Akinrinmade and Akinrinde, 2012a,b).
2. The enforcement of recycling of plastic materials and other environmental pollutants so that threat to the environment and life can be reduced (Ramaswamy and Sharma, 2011).
3. Public education through mass media on careless disposal of plastic bags as well as periodical cleaning of these wastes in the grazing area (Remi-Adewumi *et al.*, 2011; Ramaswamy and Sharma, 2011).
4. The production of biodegradable packaging materials, e.g. papers and cardboards, which would not persist in the environment or bottles and tins which can be readily recycled (Remi-Adewumi *et al.*, 2011).
5. Good husbandry practices, i.e. intensive or semi-intensive system should be encouraged. Cattle owners are advised not to allow their animals to freely wander in streets, especially in cities (Ramaswamy and Sharma, 2011).
6. The municipal authorities in cities and towns and peri-urban areas should provide covered disposal bins for polythene materials separately to avoid ingestion by animals (Reddy and Sasikala, 2012).

7. The establishment of grazing reserves across the entire geopolitical/geographic/ecologic zones of Nigeria.



**Figure 1: Cow feeding on a refuse dump (Courtesy Reddy and Sasikala, 2012).**



**Figure 2: Scavenging cattle at a grazing point littered with polythene materials (Mohammed and Mohammad, 2007).**



**Figure 3: Animals eating plastic bags (Ghurashi *et al.*, 2009).**

### **Environmental Policy on Waste Disposal**

As earlier noted in this review, polythene materials have been prominent among materials causing rumen impaction. Open dumping of residential wastes in plastic bags is noted commonly in almost all parts of municipalities, including road sides, open plots, river side and in drains. Residents commonly use plastic sacks and polythene bags for storing their wastes. From the temporary and final waste disposal sites, domestic animals like cattle, sheep, goats and donkeys prehend these plastic bags containing food materials inside (Figs. 1-3).

In recent years in Nigeria, the level of public concern and response of the government about environmental waste pollution has increased. The challenge of addressing the problem of waste pollution of the environment was endorsed in 'Agenda 21' of the 1992 Summit on environment and development by the United Nations Conference on Environment and Development (UNCED, 1992; Adedayo, 2000). The goals, as stated, seek the achievement of environmentally sound management through increased safe disposal, recovery of materials

and sustainable patterns of production and consumption of goods and services. The targets of these goals were to decouple economic growth from ultimate waste yields, prevent and minimize hazardous waste generation.

However, as in other policy areas, the Nigerian Government particularly at the local level has displayed weakness in the implementation of environmental sanitation and waste management policies. According to Adedayo (2000), this implementation gap in policy is a function of a number of constraints, including inadequate and unco-ordinated enforcement of legislation, institutional problems (e.g. shortage of manpower and financial resources, inadequate technology), inadequate public awareness and participation as well as shifts in public policy which causes distortion or discontinuity of environmental programmes or alterations in priorities.

Successful waste management in Nigeria will require a holistic approach that will integrate all the technical, economic, social, cultural and psychological factors often ignored in solid waste programs (Agunwamba, 1998).

### **Conclusions**

Rumen impaction due to foreign indigestible materials has become a major constraint at improving the fortunes of indigenous livestock productivity in Nigeria. The situation with regard to the prevalence, risk factors, diagnosis and management constitute a great challenge to both the clinician and livestock producer. The problem of waste disposal has become 'endemic' to tropical environments, with adverse effects exerted on both human and animal populations. The associated economic losses are enormous. In the light of the above, it is pertinent that prompt consideration be given to measures for prevention and control of this

condition including strict enforcement of regulations on waste disposal; enforcement of recycling of plastic materials; massive public education on careless disposal of wastes; provision of covered disposal bins and establishment of grazing reserves on the part of the government. Animal producers should adopt control measures including good husbandry practices that ensure the removal of factors that predispose animals to the ingestion of foreign materials.

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