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*Full Length Research Paper*

## **Retrospective Study of Disease Incidence and Type of Pneumonia in Nigerian Small Ruminants in Ibadan, Nigeria**

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### **ABSTRACT**

Eleven-year retrospective study was carried out on small ruminants submitted for necropsy in the Department of Veterinary Pathology, University of Ibadan between 1999 and 2010 to determine the disease pattern, incidence and type of pneumonia in small ruminants from urban and peri-urban area of Ibadan, Nigeria. Approximately 92.4% of the carcasses had their diagnosis made through post-mortem examination, while (7.6%) were inconclusive. The post-mortem diagnosis was obtained from records while the type of pneumonia was by histopathology using standard techniques. Student 't' test was used for the test of significance for evaluating the effect of age, sex and the type of pneumonia. Pneumonia was the most common 81 out of the 105 cases (69.8%). Of the 81 pneumonic cases diagnosed, peste des petits ruminants (PPR) 69 (85.2%), Mannheimiosis (MH) in 6 (7.4%), PPR and MH in 6 (7.4%). More pneumonic cases were recorded in goats (80%) than sheep (76.7%) and in rainy season (67.2%) than dry season (27.6%). The gastrointestinal tract (GIT) was the second (16.9%) which includes enterotoxemia (9%), helminthoses (4.3%) and ruminal impaction (2.6%). Severe malnutrition (2.6%), and trypanosomosis (1.72%), was the third most reported. Others includes congestive heart failure (0.9%), cyanide poisoning (0.9%), and heartwater (0.9%). Histopathologically, bronchopneumonia predominated with fibrinous (30%) and suppurative (10%) type, others were interstitial pneumonia (15%), broncho-interstitial pneumonia with giant cells (40%) and collapsed lung (5%). This showed that pneumonia still remains an important condition in Nigerian small ruminants and broncho-interstitial pneumonia with giant cells, suggestive of complicated PPR is commonly encountered.

**Keywords:** Goat, Mortality, Pneumonia, Sheep, Nigeria.

### **INTRODUCTION**

The small ruminant population of Africa is about 205 million sheep and 174 million goats representing approximately 17% and 31% of the world total, respectively (Food and Agriculture Organization of the United Nations (FAO, 1990). These animals serve primarily as sources of meat, milk, skins and manure. Sheep and goats produce about 16% of the world's meat

(Ademosun, 1988) Goats made up 42.3% of Nigerian ruminant livestock contributing about 12.7% of the total agricultural gross domestic product (Ademosun 1988). In south western Nigeria, various studies indicated that over 70% rural households in most villages keep goat or sheep (Emikpe and Akpavie 2011) with the West African dwarf goat contributing immensely to the wealth of the rural farmers.

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This small ruminant production has been limited by myriads of infectious diseases of which respiratory infections are of paramount importance. Investigations into the cause of mortality in ruminants had focused on the use of questionnaire with fewer studies on pathology and case records (Kagira and Kanyari. 2001, Anaeto et al., 2009, Ali et al., 2011). Emphasis of researchers in this aspect had also been on the description of the type and pattern of pneumonia commonly observed in beef cattle (Welsh et al., 2004) and sheep (Ikede, 1978) with very few reports in goats (Ikede 1977, Mellado et al., 1991, Al-Qudah et al., 2008) with less emphasis on other diseases. Available field reports on this aspect in Nigeria which had been over decades showed that the most important pneumonia in goat was of giant cell type (Ikede 1977), while that of sheep was that of purulent pneumonia (Ikede 1978). With the dynamics in the disease process and variations commonly observed overtime, there is a need for an update on the incidences of diseases, pattern and type of pneumonia in this important livestock. This investigation was to determine the causes of mortality, incidence and type of pneumonia in Nigerian small ruminants using gross pathology and routine histopathology as tools.

## MATERIALS AND METHODS

### Study area and selection criteria

A retrospective survey for incidence of disease and type of pneumonia was carried out between 1999 to 2010 using goats and sheep presented for post mortem in the department of Veterinary Pathology, University of Ibadan. This diagnostic laboratory an integral part of the veterinary teaching hospital receives cases and referrals from veterinarians all over Nigeria especially from the southwestern part (Eyarefe et al., 2010). The animals were both sexes with ages varying from six months to five year-old. The gross diagnosis was obtained from the departmental post mortem records.

Most of the small ruminants in this area were kept on small-scale farms, and they often provide meat, manure and basis for house hold means of livelihood. Sheep

breeds in order of prevalence were Yankasa, West African dwarf and Uda. The main breeds of goats were West African dwarf goats. The diagnosis of the diseases was based on the history and clinical signs presented prior to death and post mortem examination of the carcass revealing macroscopic lesions. Confirmation was based on histopathology, routine bacteriology including the use of special staining technique.

### Assessment and classification of the pneumonic cases encountered

Random sampling technique was adopted, one out of every five cases was used for further histopathological diagnosis. A total of 20 pneumonic lungs randomly selected archival lung samples from carcasses of goats and sheep submitted were routinely processed, cut at 4-5 µm thickness, stained with Haematoxylin and Eosin, and view using light microscope. The classifications were based on the exudates and the part of the lungs affected.

### Statistics

Descriptive statistics was used to describe the age, sex, season, year influences on the occurrence of pneumonia. Student t-test was used for the test of significance.

## RESULTS

### Incidence rate

Approximately 92.4% of the carcasses had their diagnosis made through post-mortem examination, while (7.6%) were inconclusive. Pneumonia was the most common 81 out of the 105 cases (69.8%). Of the 81 pneumonic cases diagnosed, peste des petits ruminants (PPR) 69 (85.2%), Mannheimiosis (MH) in 6 (7.4%), PPR and MH in 6 (7.4%). The gastrointestinal tract (GIT) was the second (16.9%) which includes enterotoxemia (9%), helminthoses (4.3%) and ruminal impaction (2.6%). Severe malnutrition (2.6%), and trypanosomosis (1.72%), was the third most reported. Others includes congestive heart failure (0.9%), cyanide poisoning (0.9%), and heartwater (0.9%)

**Table 1**  
Season and occurrence of pneumonia cases in sheep and goats

Season	Total no. of goats	No. affected	Total no. of sheep	No. affected
Rainy season (Feb-Sept)	58	48 (82.8%)	20	16 (80%)
Dry season (Oct-Jan)	22	16 (72.7%)	10	7 (70%)
Total	80	64 (80%)	30	23 (76.7%)

**Table 2**  
Ages of cases of animals diagnosed

Age	Total	Goats	Sheep
<1 year	28	14 (50%)	14 (50%)
1-2 years	24	14 (58.3%)	10 (41.7%)
2-3 years	12	10 (83.3%)	2 (16.7%)
>3 years	21	19 (90.5%)	2 (9.5%)
Unspecified	22	15 (68.2%)	7 (31.8%)

### Effects of season on cases diagnosed

Seasonal influence was observed with more of the pneumonic cases being recorded in the rainy season (67.2%) than dry season (27.6% (Table I).

### Effects of species on the cases diagnosed

In terms of disease incidence, more goats were affected in the wet season (82.8%) and sheep (80%) as compared to the dry season 72.7%, 70% for goats and sheep respectively. Also pneumonic cases are more in goats (80%) than sheep (76.7%).

From the records, the sex and breed influence cannot be easily deduced however 85% of the cases affected were of the West African dwarf breeds.

### Effect of age on the occurrence of pneumonia

From the postmortem record, animals of less than a year to two years old were more affected as compared to that of two years and above (Table II). The condition was

**Table 3**  
Species of animals affected per year between 1999 and 2010

Species	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Goat	4	9	12	8	3	13	16	5	4	6	3	3
Sheep	1	8	6	2	0	7	1	1	2	0	1	0
Total	5	17	18	10	3	20	17	6	6	6	4	3

**Table 4**  
Histopathological diagnosis of pneumonia in archival caprine lungs  
One of the lung samples was collapsed

Species	Type of pneumonia					Total
	Fibrinous pneumonia	Purulent pneumonia	Interstitial pneumonia	FP and giant pneumonia	PP and giant pneumonia	
Sheep	2	0	1	3	0	6
Goat	4	2	2	4	1	13
No. of animals	6 (30%)	2 (10%)	3 (15%)	7 (35%)	1 (5%)	19 (100%)

FP fibrinous bronchopneumonia  
PP purulent bronchopneumonia

also diagnosed more in the young to 1-2 years old animals while the adult animals from 2 years of age suffered from pneumonia with or without other non-pneumonic diseases.

### Effect of year on the frequency of pneumonia

The highest number of cases of pneumonia (20) was recorded in 2004 as shown by Table III.

### Histopathological diagnosis

One in each five samples was taken randomly for histopathological examination. Consistent features were those of proliferative changes in the alveoli wall and bronchiolar mucosa, necrosis with sloughing off epithelial cells, vascular changes due to endothelia damage, congestion of pulmonary vessels and capillaries, exudative changes were evident by accumulation of inflammatory fluid and cells such as neutrophils, macrophages and lymphocytes. Also present were proteinaceous pink materials with nodular hyperplasia, zone of inflammation around the bronchioles, alveolar septa changes, giant cell formation with one or two aggregate bronchial associated lymphoid tissue (BALT).

Table IV gives the histopathological diagnosis, bronchopneumonia was predominant with fibrinous (6) or suppurative (2) pattern, others were interstitial pneumonia (3), broncho-interstitial pneumonia with giant cells (8) and a collapsed lung.

**Table 5**

Results of gross and histopathological diagnosis

No.	Post-mortem no.	Species	Age	Gross diagnosis	Histopathological diagnosis	Agreement
1	50/01	Caprine	Adult	PPR	Interstitial pneumonia	++
2	87/01	Ovine	Adult	PPR	Fibrinous bronchopneumonia and giant cell pneumonia	+
3	90/02	Caprine	Kid	PPR and pasteurellosis	Fibrinous bronchopneumonia and giant cell pneumonia	+++
4	06/02	Ovine	Lamb	PPR	Fibrinous bronchopneumonia and giant cell pneumonia	+
5	13/03	Caprine	Young adult	PPR	Fibrinous bronchopneumonia and giant cell pneumonia	+
6	39/03	Ovine	--	Pasteurellosis	Fibrinous bronchopneumonia and giant cell pneumonia	+
7	43/04	Caprine	Kid	PPR and pasteurellosis	Fibrinous bronchopneumonia and giant cell pneumonia	+++
8	50/04	Ovine	Lamb	PPR and pasteurellosis	Suppurative pneumonia and giant cell pneumonia	+++
9	15/05	Caprine	Young adult	PPR	Interstitial pneumonia	++
10	25/05	Caprine	--	PPR	Interstitial pneumonia	++
11	12/06	Caprine	Adult	Ruminal impaction	Fibrinous bronchopneumonia	-
12	50/06	Caprine	Adult	PPR	Fibrinous bronchopneumonia	+
13	48/07	Caprine	Adult	PPR	Fibrinous bronchopneumonia	+
14	58/07	Ovine	Adult	PPR	Collapsed lungs	-
15	29/08	Ovine	Young adult	PPR	Bronchopneumonia	++
16	47/08	Caprine	Adult	PPR	Fibrinous bronchopneumonia and giant cell pneumonia	+
17	80/09	Caprine	Adult	--	Fibrinous bronchopneumonia	-
18	83/09	Caprine	Young adult	PPR	Fibrinous bronchopneumonia	+
19	86/10	Caprine	Kid	PPR	Suppurative bronchopneumonia	+
20	87/10	Caprine	Kid	PPR	Suppurative bronchopneumonia	+

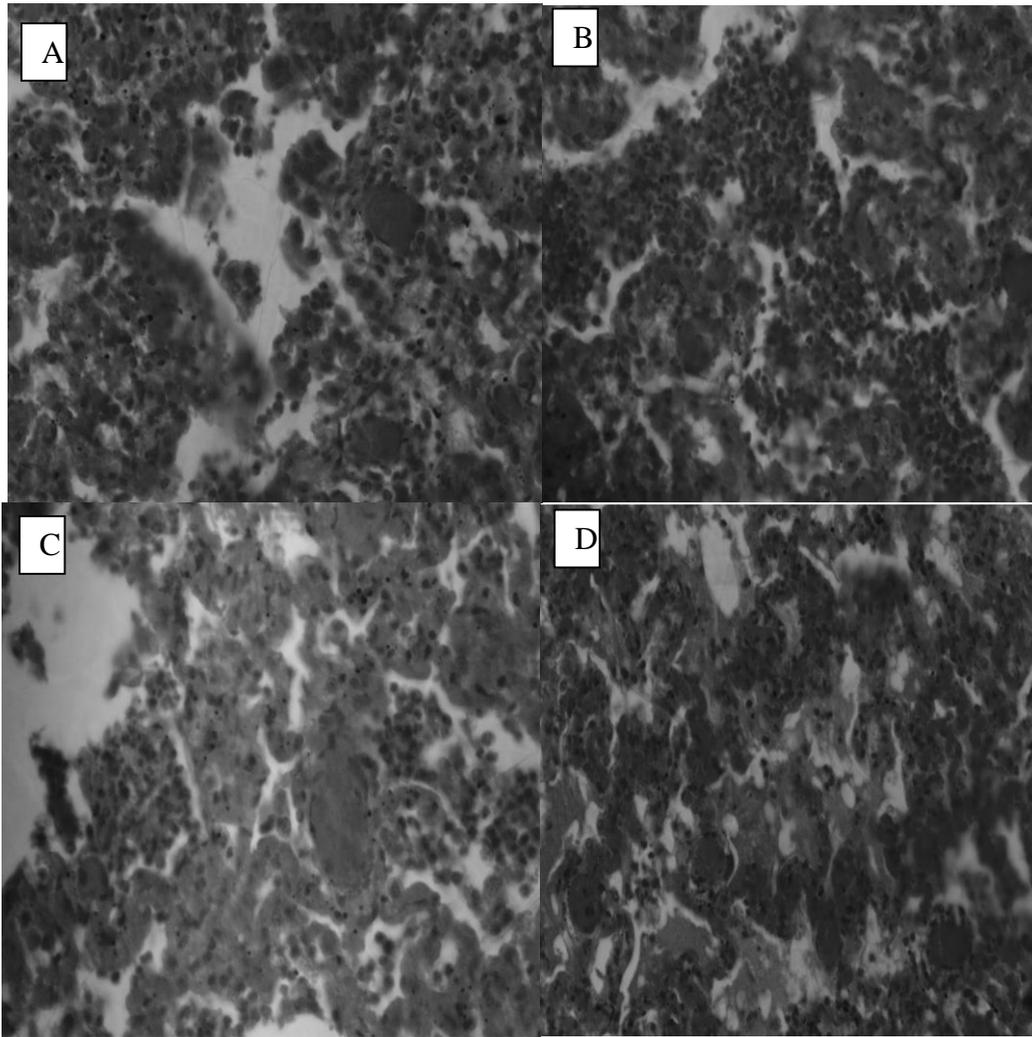
+ diagnosis of pneumonia at both gross and histopathology  
 ++ strong agreement of gross and histopathological diagnosis  
 +++ very strong agreement between both  
 - disparity

### Interstitial pneumonia

Lesions were characterised by thickening of the alveolar septa walls, increased in mononuclear cells in the interalveolar septa and presence of varying numbers of macrophages within the alveolar lumina peribronchial and peribronchiolar proliferation of lymphocytes was detected in many interstitial pneumonia with characteristic syncytial cell formation (giant cells) Fig. 1A. There is also a mild neutrophil exudation within the alveolar lumina, these type were bronchointerstitial pneumonia.

### Purulent (suppurative) bronchopneumonia

There was endothelial damage, marked consolidation of the parenchyma with many neutrophils in the alveoli. More extensive and necrotic changes with neutrophilic infiltration of the alveoli were observed with few macrophages Fig. 1B and interspersed red blood cells. Severe desquamation of the bronchial and bronchial epithelium with hyperplasia of the bronchial associated lymphoid tissues was also observed.



**Plate 1**

A- Giant cell pneumonia, B- purulent pneumonia, C and D- Fibrinopurulent pneumonia

**Fibrinous bronchopneumonia:** had inflammatory zone around the respiratory bronchiole with abundant fibrinous exudates and visible fibrin strand. Interlobular septa, pleura and alveoli distended because of fibrinous exudation and neutrophilic exudation Figs 1C and 1D. Lymphatic capillaries were obstructed with fibrin thrombosis. Inter alveolar capillaries were congested and enlarged.

The details of the association between the gross and histopathological diagnosis was shown in Table V. The results showed that both diagnoses detect pneumonia (50%) of all the cases but the actual type and pattern of the pneumonia were obtained by the histological examination.

**DISCUSSION**

This investigation showed pneumonia as the major condition that result into mortality of goats and sheep presented for post mortem in the department of Veterinary Pathology University of Ibadan between 1999 and 2010. This is representative of the nature of cases commonly encountered in Nigeria. This study

demonstrates that pneumonia remains an important cause of mortality in small ruminants, closely followed by gastro intestinal conditions which include helminthoses and ruminal impaction.

Cases of pneumonia are more in the very young to young adult animals (6 months to 2 years) especially in the goat which reveal the susceptibility of these groups to pneumonia especially the devastating effect of PPR virus. This further corroborated the reports of other workers (Odugbo et al., 2004, Emikpe and Akpavie 2010, Lawal et al., 2011). This investigation further lend credence to the fact that secondary bacterial complications may be the factor that resulted into the mortality and severity of field PPR (Ezeibe et al., 2008, Ali et al., 2011).

That young animals suffer more may also be due to stress associated with early weaning or absence of maternally derived antibodies and unrestricted movement which they are frequently subjected to. In this study, it was observed that the adult animals do not readily come down with pneumonia but the effect of stress or secondary bacterial infection may be the

possible reason for the mortality pattern recorded in adult goats (Emikpe and Akpavie, 2011).

In this study, the sex and breed pattern could not be deduced. However previous studies showed that male goats are more prone to infection possibly due to the sniffing of the females during estrus (Emikpe and Akpavie 2010) as this behaviour exposes them to the virus especially from infected animal with diarrhoea since the faeces is known to be rich in the virus (Durojaiye 1984, Ezeibe et al., 2008) and the virus is excreted via all the excretions during the pyrexia phase (Abegunde and Adu 1977).

This retrospective investigation further revealed that pneumonia is more prevalent in the rainy season ranging from February all through October annually as compared to dry season. This further corroborated the reports of other workers (Mellado et al., 1991, Lawal et al., 2011) and is in contrast with the report of Okoli (2003) who reported higher incidence of PPR during the dry months of December and January and that was attributed to dusty and dry Hamattan wind which has been said to enhance the spread of PPR and that of the saprophytic organisms in the air passages responsible for the initiation of pneumonia (Al-Tarazi and Daghall 1997).

The prevalent pneumonia in this investigation is that of bronchointerstitial pneumonia characterized by inflammatory changes around the terminal bronchioles and surrounding alveoli walls, with cases of complication more of fibrinous or suppurative bronchointerstitial pneumonia with presence of syncytial giant cells. The fibrinous bronchopneumonia or broncho interstitial pneumonia is more consistent with goats than in sheep. This further corroborated the findings that complicated PPR is commonly found in goats than sheep (Lawal et al., 2011). These findings also reaffirm the fact that pneumonia is essentially triggered by sudden exposure to stressful condition or by initial infection with certain respiratory viruses (Jasni et al., 1991). This probably explains the association observed between PPR and bronchopneumonia as reported by Okoli (2003).

In this investigation, giant cells observed is suggestive of PPR in goats in this environment (Lawal et al., 2011), the high prevalence observed in archival lung tissue further confirms the report of Ikede (1977), that PPR is still prevalent in goats from this environment. It also revealed that the predisposing factors that precipitate outbreaks of PPR such as history of non-vaccination, movement of animals across trade route, transboundary and within herd, stress and poor management are not well attended to in the last thirty three years (Lawal et al., 2011).

Another striking finding is the increasing occurrence of ruminal impaction in the most recently necropsied

carcasses, this may be adduced to the urban environment having inadequate forages for the ruminants to browse, the animals tend to eat up polythene wastes, which if not diagnosed and surgical intervention undertaken compromised ruminal function and could result into sudden death. This increasing occurrence can be attributed to the lack of pasture grazing and intensive management for this livestock especially in the urban centres.

From the analysis of the result, there is a strong relationship between mortality in small ruminants and occurrence of pneumonia (75%) followed by that of other diseases. This showed that pneumonia is a major setback for small ruminant production (Lawal et al., 2011). There is also a strong degree of association of the gross and histopathological diagnosis in detection of pneumonia and diseases related with pneumonia. This may be related to the level of knowledge of the disease in the environment and the expertise of the pathologists involved in the disease diagnosis over years

In conclusion, this study has been able to show that pneumonia is still the most important condition in sheep and goats in south-western Nigeria. It also shows an increasing incidence of ruminal impaction associated with urbanisation and limited forages. It also stressed the importance of histopathological examination in the diagnosis of pneumonia as it gives a clue to the morphological and type for prompt control and treatment in any outbreak. Further study is focussed on the control of pneumonia in Nigerian small ruminants.

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