

Research Article

Evaluation of Lung Lesions and Associated Predisposing Factors from Slaughtered Pigs in Nigeria

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Abstract

Pigs are prolific and fast growing livestock but certain factors limit its production in Nigeria. The incidence, and pattern of pneumonia, its associated predisposing and risk factors were studied in pigs slaughtered at the major Municipal abattoirs in southwest Nigeria. Pigs weighing 80-160kg body weight were examined for over three months at abattoirs. The age, sex and breed of the animals were noted. Gross visual appraisal of pneumonic lesions was made as percentage of lung tissue affected while lung samples were processed routinely for detailed histological examination. A total of 250 pigs were clinically examined. Males comprise 19.4% and females 80.6%. The breeds slaughtered include large white (85.5%), large black (6.5%) and Duroc cross (8%). 90 pigs were randomly sampled for the morphometric and pathological evaluations, out of which 62 were pneumonic. The large white breed had the highest lung consolidation score (11) as compared to large black (9.7) and duroc (9.0). The mean consolidation score was also high in the female and the right lobes had lung consolidation scores more than left lobes. The histologic patterns of pneumonia include congestion and oedema (9%), atelectasis (3%), fibrinous (17%) and suppurative bronchopneumonia (2%), broncho-interstitial pneumonia (32%), verminous pneumonia (2%) and granulomatous pneumonia (4%) and normal (31%). The male pigs were more predisposed to pneumonia, and breed is a major risk factor to pneumonia in this environment. There is need for strict implementation of control measures on curbing porcine pneumonia.

Keywords: *Pneumonia, Pathology, Risk factors, Swine, Nigeria*

INTRODUCTION

Respiratory diseases are a major concern in swine production worldwide (Loera-muno *et al.*, 2013). The examination of lung lesions from fattening pigs at slaughter is a good tool for estimating the importance of the respiratory diseases in this livestock (Losinger, 2005).

In most developing countries like Nigeria, the burden of porcine respiratory diseases is largely underreported; however, the clinical cases of infectious and non-infectious respiratory diseases appear to be on the increase (Noyes *et al.*, 1990). Pig production in Nigeria especially in south west is on the increase and therefore requires due attention. More so, very little has been reported on respiratory diseases of pigs in south western Nigeria in the last three decades (Antia *et al.*, 1981). The main importance of this study is to provide relevant data on the incidence, epidemiology, gross pathology and histopathology of lungs obtained from slaughtered pigs. Also, bring to the forefront, the prevalence of pneumonia in this livestock as it occurs in the natural environment.

Morrison *et al.* (1986) reviewed relation between fattening or growth in pigs and lung lesions at slaughter. More than 50% reported a positive correlation between growth and lung lesions in the affected animals. Evaluation and occurrence of pig pneumonia shall be better monitored with good documentation of pigs slaughtered at major pig slaughtering abattoir in south western Nigeria. This study will therefore provide opportunity of reporting the incidence of pneumonia in pigs slaughtered at these abattoirs.

MATERIALS AND METHODS

Abattoir and Animals: The population under study comprised adult pigs from different farms, largely from the south western states of Lagos, Oyo, Osun, and Ogun because of the wide acceptance of the animal.

The two major abattoirs selected in the south western part of Nigeria are Bodija Abattoir, Ibadan and Oko Oba abattoir, Lagos. These two abattoirs are municipal abattoirs supplying the major pork consumption of the residents. The sampling period was from October to December 2014.

Approximately 45-50 pigs of between 80-160kg body weights were slaughtered per week. After slaughter and evisceration, the plucks were picked for examination and assessment of lesions on the lungs. Photograph of the whole lung *ex situ* (dorsal and ventral surfaces) was taken for each slaughtered pig.

Post-mortem evaluation of pneumonia: Gross examination of the lungs for changes in consistency, texture, color and degree of distribution was as described by Lopez (2012). The extent of pneumonia was determined by visual observation, palpation and measurement of the lesion which was then manually plotted onto a lung diagram for estimation as a percentage of each lobe (Emikpe & Akpavie 2011).

Morphometric evaluation: For this purpose, the surfaces of macroscopically unaltered lungs of pigs at slaughter were

measured and the quantitative proportion of each lobe to the whole lung was calculated as a percentage of the total lung surface. Subsequently, the lungs were schematically divided into lung lobes according to their anatomical nomenclature. Each of the seven lobes was consecutively numbered on the ventral and dorsal side, and the surface proportion in relation to the total lung surface was calculated.

Pneumonia was scored based on Madec method, and as modified by Ostanello *et al.* (2007) and Cevi (2010) considering the contribution of each lobe to the overall capacity of the lungs (Christensen 1999).

Histopathology: The lung tissues 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.

Data analysis:

Data were descriptively analysed, presented in percentages and mean, non-parametric tests were used to test significance at 5%.

RESULTS

Incidence and Distribution; A total of 250 pigs were examined clinically ante-mortem. Most of these pigs were apparently healthy. The distribution of these animals is shown in Table 1.

Breed- It was observed that only three breeds were frequently slaughtered: large white (214), large black (16) and Duroc cross (20).

Age and Sex : All pigs slaughtered were finished pigs and above 8 months old, invariably, all were adults or of table size for pork. The percentage of female pigs (80.6%) slaughtered was higher compared to that of males (19.4%) Afterwards, 90 pigs were randomly sampled for gross and microscopic examinations. Of which 62 (69%) from the 90 randomly sampled pigs had different degree of pulmonary congestion and consolidation (pneumonia).

Lung consolidation pattern: Grossly, 28 (31%) were of normal colour, texture and consistency while 62 (69%) were pneumonic (figure 1). The large white breed had the highest lung consolidation score (11.0), compared to large black (9.7) and duroc (9.0) breeds respectively (p<0.05). The mean consolidation score was also high in the female (p<0.05). Comparatively, the right lobes had the highest lung consolidation scores, except in the duroc and large white breeds (p>0.05). The individual lobar consolidations are also presented in Table 2.

Table 1: Breed and Sex distribution of slaughtered pigs from two major abattoirs

Breed	Male	Female	Total
Large white	16 (6.5%)	198 (79%)	214 (85.5%)
Duroc cross	16 (6.5%)	4 (1.6%)	20 (8.1%)
Large black	16 (6.5%)	0	16 (6.5%)
Total	48 (19.4%)	202 (80.6)	250

Histopathology

Generally, the changes observed on histological examination of the lungs revealed proliferative changes in the alveoli wall and bronchiolar mucosa, necrosis with sloughing of epithelial cells, vascular changes due to endothelia damage, congestion of pulmonary vessels and capillaries, exudative changes evident by accumulation of inflammatory fluid and cells such as neutrophils, macrophages and lymphocytes.

Specific morphologic changes include; diffuse and severe pulmonary congestion and oedema (7) (figure 2) and pulmonary atelectasis (3) which was 120 characterized by slightly congested alveolar walls lying in close apposition with slit-like residual lumina and sharp angular ends (figure 3). Fibrinous bronchopneumonia (15) characterized by fibrinous exudate, fibrin strands and cellular debris.

There was also neutrophilic exudate in the alveoli and bronchioles (figure 4). Suppurative bronchopneumonia (2) was characterized by marked cellular infiltrates in the parenchyma with many degenerate neutrophils in the alveoli.

Table 2: Lung consolidation score observed in the lungs from slaughtered pigs based on breed

Breed	n	Mean LCS	Right lung	Left lung	LAC	LPC	LC	As	R. Cr	R.M	R.C
Large white	52	11.0±1.0	6.8±0.7	4.2±0.6	0.6±0.1	0.9±0.2	2.7±0.4	0.0±0	1.1±0.2	1.2±0.2	4.5±0.6
Duroc cross	5	9.0±2.0	4.4±1.1	4.6±1.2	0.8±0.5	0.7±0.4	3.2±0.6	0.0±0	0.6±0.4	0.7±0.6	3.0±0.8
Large black	5	9.7±1.6	4.3±1.4	5.4±1.6	0.1±0.1	0.5±0.3	4.7±1.6	0.0±0	1.2±0.1	0.7±0.5	3.1±1.6
Cumulative	62	10.7±1.6	6.4±1.1	4.3±1.0	0.6±0.1	0.9±0.2	2.9±0.5	0.0±0	1.1±0.2	1.1±0.3	4.3±0.9
Sex											
Male	12	9.8±1.6	5.3±0.9	4.5±0.9	0.5±0.2	0.7±0.2	3.4±0.8	0.0±0	0.8±0.2	0.8±0.3	3.79±0.9
Female	50	10.9±1.0	6.7±0.8	4.2±0.6	0.5±0.1	0.9±0.2	2.7±0.4	0.0±0	1.12±0.3	1.2±0.2	4.42±0.6
Cumulative	62	10.7±1.6	6.4±1.1	4.3±0.8	0.6±0.1	0.9±0.2	2.9±0.5	0.0±0	1.1±0.2	1.1±0.3	4.3±0.9

LCS: lung consolidation score, LAC: left anterior cranial, LPC: Left posterior cranial, LC: Left caudal, As- Assessorry lobe; R.Cr.: right cranial, RM: right middle, RC: Right caudal.

More extensive and necrotic changes with infiltration of neutrophils in the alveoli were observed with few macrophages and interspersed red blood cells in the lungs.

Interstitial pneumonia (29) was characterized by pulmonary congestion and edema with marked cellular (neutrophils, macrophages and lymphocytes) and proteinaceous exudate into the alveolar and bronchoalveolar interstitium thus distending the alveoli septate. There was also marked congestion of alveolar capillaries.

Granulomatous pneumonia (4) was 121 characterized by extensive discrete (10-20µ) to lobular nodules in the pulmonary parenchyma (plate 5). Verminous pneumonia (2) with intra-lesional parasites (section of larva and adult stages) was also observed (plate 6) and while 28 were normal. The breed distribution of these changes is shown in Table 3.

DISCUSSION

Our results showed that pneumonia is the prevalent lung lesions detected at the slaughterhouses. This is in agreement with studies of Leneveu *et al.*(2005) carried out in western

France where 72.4% and 14.4% of the pigs were found to be affected by pneumonia and pleuritis, respectively. Results of studies in other countries have also shown that lung diseases are widespread in pigs raised under confined and intensive systems with prevalence ranging from 21% to 72% and 14.4% to 62% of the pigs for pneumonia and pleuritis, respectively (Alegre *et al.*, 2008; Fraile *et al.*, 2010; Meyns *et al.*, 2011). Abscesses and nodules were less frequent at both pig and herd levels in this study, as previously reported (Leneveu *et al.*, 2005; Dailidaviciene *et al.*, 2008).

Almost all the males slaughtered and sampled showed evidence of lung pathology. This probably suggest sex predisposition. However, this may not be unconnected to their sexual activities and activeness. This study also shows that the large white breeds are most susceptible.

Healing following bouts pneumonia can be a frequent alteration observed in the lung, thus suggesting recovery from pneumonic lesions as at the time of slaughter (Wallgren *et al.*, 1994). This process is slow and can run for weeks, also suggesting that pneumonia had developed early in the fattening phase (Kobisch *et al.*, 1993, Sørensen *et al.*, 1997).

Table 3:
Breed distribution of pulmonary morphological changes in slaughtered pigs

Breed	Histopathological changes							Total
	Normal	Interstitial pn	Broncho pn	Granulomatous pn	Congestion & oedema	Atelectasis	Verminous	
duroc	3 (3%)	3 (3%)	2 (2%)	0	0	0	0	8 (9%)
large black	1 (1%)	1 (1%)	2 (2%)	1 (1%)	1 (1%)	0	0	6 (7%)
large white	24 (27%)	25 (28%)	13 (15%)	3 (3%)	6 (7%)	3 (3%)	2 (2%)	76 (84%)
Total	28 (31%)	29 (32%)	17 (19%)	4 (4%)	7 (8%)	3 (3%)	2 (2%)	90 (100%)

Pn- pneumonia.

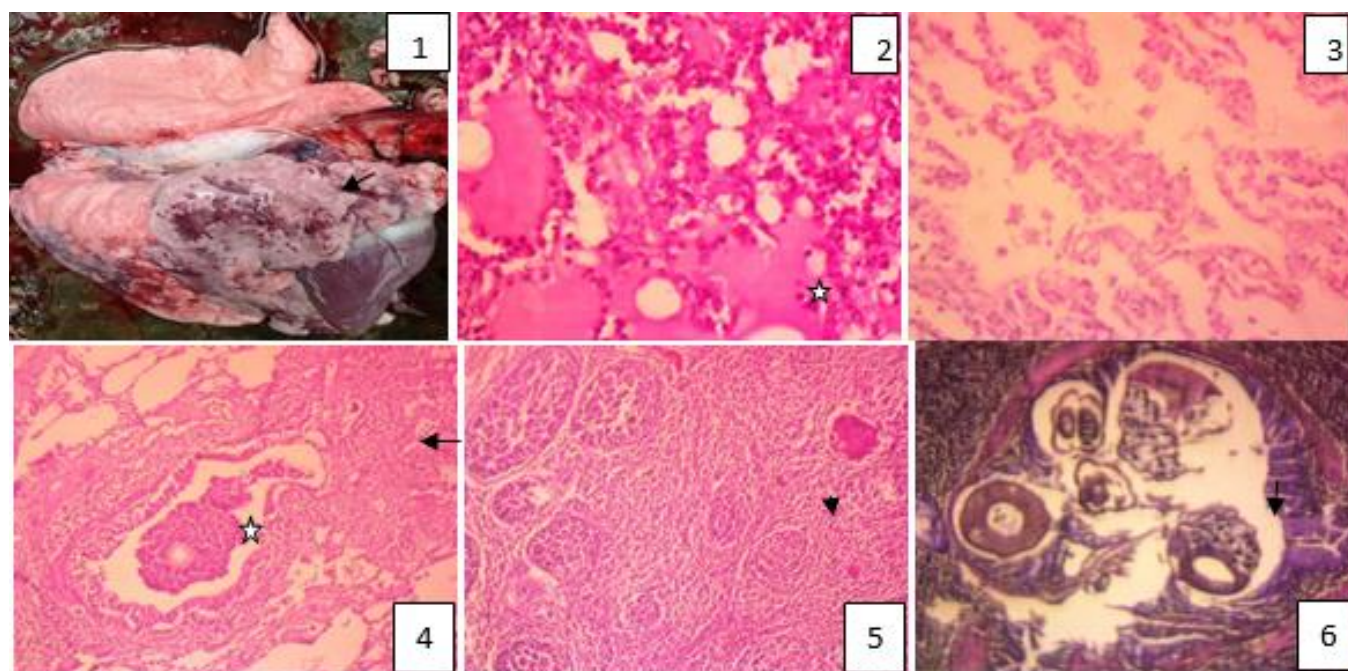


Plate: 1-
Cranio-ventral consolidation (arrow). 2- Congestion and oedema (asterick) in airspaces. 3- Pulmonary atelectasis. 4- Bronchopneumonia with exudate in airway (asterick) and airspaces (arrow). 5- Granulomatous pneumonia (arrow). 6- Verminous pneumonia with larva in airway (arrow) HE x400

Interstitial pneumonia is also more prevalent based on the pattern of lung surface lesion and on histopathological findings. This pattern is quite different to that observed by Antia *et al.* (1981) where more of bronchopneumonia and enzootic pneumonia were reported. Clinically, this could be suggestive of different aetiological agents.

These correlations may have underscored the roles of different causal factors. This is based on the fact that bacterial diseases should be in concordance with lesions of bacterial pneumonia while viral diseases should reveal lesions of viral type of pneumonia. In this study, interstitial pneumonia, bronchopneumonia- fibrinous or suppurative pattern, broncho-interstitial pneumonia, verminous and granulomatous pneumonia were reported. All these suggest underlying viral, bacterial and even parasitic aetiologies. More diagnostic and control measures so as to curb losses in pigs.

Lung lesions at slaughter are only a reflection of the respiratory diseases met by the animal during its life (Morris *et al.*, 1995, Noyes *et al.*, 1990), especially the recent ones. This probably explains the absence of correlation observed by some authors between the extent of lung lesions at slaughter and the growth during the fattening period: the very late pathological outbreaks may have a very limited effect on the whole fattening period growth.

Slaughterhouse inspection is widely used to assess the subclinical respiratory health status of pigs (Maes *et al.*, 2001; Leneveu *et al.*, 2005). These data are important to monitor lesion incidence and severity. They can also be used to identify risk factors for lung lesions including breed and age (Ostanello *et al.*, 2005, Fraile *et al.*, 2010) and as observed in this study. This information is extremely useful to further implement adequate control strategies.

In conclusions, Lung lesions are frequently detected in the lungs of finishing pigs, pneumonia being the most prevalent lesions both at the pig and herd level. The male pigs are more predisposed to pneumonia, and while breed may be a major risk factor in this environment. Non- infectious factors related to herd management; hygiene and housing conditions need to be properly considered in control programmes aiming at reducing the impact of respiratory diseases, which in turn would improve pig performance and welfare. Use of vaccination towards respiratory pathogens like *Mycoplasma*, *Actinobacillus* should also be encouraged.

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