



Husbandry Practices and Outbreak Features of Natural Highly Pathogenic Avian Influenza (H₅N₁) in Turkey Flocks in Nigeria, 2006-2008

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ABSTRACT

The Highly Pathogenic Avian Influenza (HPAI) outbreaks in Nigeria that occurred during 2006-2008, affected 80 farms that kept subsistence indigenous chicken, duck, turkey, guinea fowl and geese in 15 states of the country including the capital, Abuja resulting in a total loss of more than 14,000 birds in backyard, semi-intensive or free-ranged flocks. The rearing of rural poultry in free-range, multispecies, multiage holdings that have low biosecurity levels have shown to expose them to many contact risks. In order to sustain turkey production in the country in view of the ongoing resurgent HPAI outbreaks, it is necessary to assess the impact of HPAI on this species and to evaluate the husbandry and outbreak features of affected flocks. Spatial data confirmed the presence of HPAI virus in both domestic and commercial poultry farms from 25 States and the Federal Capital Territory (FCT) in Nigeria were added to a Geographical Information System (GIS) using ESRI ArcGIS 10.3 (ESRI®, USA) and QGIS 2.8.2 Desktop (OSGeo) and visualized using QGIS. Post mortem examinations of submitted carcasses were carried out and swabs and tissues were analyzed by virus isolation (VI) and reverse transcriptase polymerase chain reaction (RT-PCR). HPAI in turkey flocks were mostly in northern part of the country where most poultry mainly subsistence are domiciled and are more in the densely cities of the north. The poultry management systems employed by the subsistence turkey farmers were mainly semi-intensive backyard and free-ranged system of poultry. HPAI introduction sources vary from the introduction of new poultry species (geese and turkey) from LBM, to the death of neighborhood poultry and extension to turkey flocks and/or contact with free-ranging local chickens. It is obvious that the husbandry and the management system had influenced on the introduction of the virus and the course of the disease.

Key words: HPAI Outbreak, Husbandry, Turkey

INTRODUCTION

During 2006-2008 Highly Pathogenic Avian Influenza (HPAI) outbreak in Nigeria occurred on 80 farms that kept subsistence indigenous chicken, duck, turkey, guinea fowl and geese in 15 states (Kano, Jigawa, Kaduna, Katsina, Zamfara, Adamawa, Bauchi, Yobe, Bornu, Benue, Nasarawa, Plateau, Taraba, Lagos and Edo) of the country including the capital, Abuja were infected by the virus, resulting in a total loss of more than 14,000 birds in backyard, semi-intensive or free-ranged flocks (Akanbi and Taiwo, 2014). This acute, generalized, fatal disease in chickens and turkeys is however infective to other gallinaceous birds such as ducks, guinea fowls, geese, quails, ratites, passerine birds, flamingos, herons and raptors (Klopfleisch et al., 2006). The first suspicion of HPAIV in Nigeria was at a farm in Kaduna state (Joannis et al., 2006, Adene et al., 2006, Maina, 2006) and this index case farm had mixed avian species including free-ranging birds, small number of geese, turkeys and ostriches which were

raised in the open and affected by the outbreak with 100% turkeys mortality (De Benedictis et al., 2007). In many parts of the country, poultry farming is largely rural and for subsistence, providing food and additional income for the family and poultry management system in Nigeria. It is comprised of intensive, extensive and semi-intensive, and differentiated on the basis of their flock size and input and output relationship (Sonaiya, 2005). The types of poultry that are commonly reared in Nigeria are chickens, ducks, guinea fowls, turkeys, pigeons and more recently ostriches (Adedeji et al., 2014). Chicken, guinea fowls and turkeys are important for commercial or economic purposes amongst which the chicken predominate (Egwu, 2009). The farms are most often mixed with multiple species of animal at different ages kept together (Meseko et al., 2007) with the introduction of new birds to an existing stock as common practice (De Benedictis et al., 2007 and Meseko et al., 2007). Turkey production is still at

subsistence level characterized by poor feeding, housing, breeding and marketing. A large percentage of turkey production in different parts of the country is kept as either extensive or semi-intensive rearing (Amo et al., 2014, Baba et al., 2014). Improving turkey production requires a more vigorous public extension service on management and marketing strategies. It also calls for the introduction of improved local or crossbred turkey with a higher genetic potential (Amo et al., 2014) for disease resistance. The objective of this work is to study the husbandry and outbreak features of natural HPAI virus infection in turkeys reared with other poultry species flock in Nigeria between 2006 and 2008 and to identify the possible source of introduction of the virus into the flocks in order to derive control measures which can be applied to the ongoing resurgent HPAI outbreaks in the country.

MATERIAL AND METHODS

Study Area and Spatial Methods

Nigeria lies within the latitude 4°–14°N and the longitude 2°–15°E with a land area covering 923 763 km². Nigeria is composed of 36 states (Figure 1a) with Abuja designated as the Federal Capital Territory (Akanbi et al., 2014). Poultry population in the country is composed of 84% indigenous (domestic) and 16% exotic (commercial) (Adene and Oguntade, 2006; FAO, 2008). While subsistence poultry (domestic) is estimated to consist of 52.3million: chickens, 7.6 million guinea fowls, 3.6 million ducks, 0.4 million turkeys and other birds' accounts for the remaining 1.2 million (Adene and Oguntade, 2006 and FAO, 2008). Although, the poultry population which is now 140 million (Figure 1b) is composed of 60% backyard and 40% commercial (Adene and Oguntade, 2006; figure 1c).

This study covered the period from January 16, 2006 to December 31, 2008, within which; the detection of HPAI H5N1 began and ended during the 2006-2008 outbreak in Nigeria.

Spatial Data

Geographic coordinates of 299 confirmed outbreaks HPAI virus in both domestic and commercial poultry farms from 25 States and the Federal Capital Territory (FCT) in Nigeria (NVRI 2006-2008) were added to a Geographical Information System (GIS) using ESRI ArcGIS 10.3 (ESRI®, USA) and QGIS 2.8.2 Desktop (OSGeo). The spatial data was then visualized using QGIS.

Husbandry and Outbreak Investigation

The husbandry type practiced by the affected farms were classified and used as the basis for analyzing the production while the outbreak cases were classified into types of farms, i.e., turkey farms and/or mixed (turkey, chicken, duck) poultry farms. The outbreak was investigated by post mortem examination of the carcasses presented, and swabs and tissues were confirmed by Virus Isolation (VI) and reverse transcriptase polymerase chain reaction (RT-PCR) as described earlier (Akanbi and Taiwo, 2014).

Data Collection

Data on location, flock size and species of poultry, and mortality records used in this study were supplied directly by the seventeen (17) clients who reported and submitted turkey carcasses for avian influenza testing to the National Veterinary Research Institute (NVRI), Central Diagnostic Laboratory, Vom, Nigeria.

RESULTS

Study Area and Spatial Analysis

The human population density of Nigeria is patterned around main cities (Kano, Katsina, Sokoto, Jigawa, Lagos, Oyo, Osun, Ekiti, Enugu, Anambra, Imo, Abia, Akwa Ibom and Rivers). The majority of which are in the south (Lagos, Oyo, Osun, Ekiti, Enugu, Anambra, Imo, Abia, Akwa Ibom and Rivers) of the country (Figure 1a). While poultry population comprising of 84% indigenous (domestic) and approximately 50% subsistence of the 140 million are domiciled in the north (Bauchi, Katsina, Jigawa, Kebbi, Zamfara, Benue and Borno) of the country (Figure. 1b). HPAI affected mostly northern part of the country where most poultry mainly subsistence are domiciled including Adamawa state (Figure 1c). When the human population was compared to the HPAI outbreaks, it revealed that the outbreaks also follow and are more in the densely cities of the north (Figure 1d).

Husbandry and Outbreak Investigation

The poultry management systems employed by the subsistence turkey farmers were mainly semi-intensive backyard and free-ranged system of poultry rearing. Although, intensive poultry production system (Figure 2a and 2b) is been practiced by majority of the HPAI infected farms in the country, infected turkey farms investigated practiced backyard (Figure 2c), mixed species (Figure 2d) and free-ranged system (Figure 3a, Figure 3b and Figure 3c) and occasionally, improvised housing is provided (Figure 3d and Figure 3e) by free ranged poultry owners. Swabs and tissues from carcasses of affected flocks were tested for HPAI by virus isolation and as earlier described (Akanbi and Taiwo, 2014) and all samples from the turkeys were found positive for HPAI H5N1 virus. Post mortem examination of the turkey carcasses presented revealed lesions associated with circulatory (vascular congestion and haemorrhages), respiratory (nasal exudation, airsacculitis and pneumonia) and Gastrointestinal (enteric petechiation and ecchymoses) with mild nervous lesion. Some of the post mortem lesions are depicted below in figure 4a-d.

Data Analysis

The data provided by the owners/farmers of the affected turkey flocks in this study showed that affected turkey flocks were mainly in the northern parts (Kaduna, Katsina, Nasarawa, Plateau, Taraba, Kano, Edo, Jigawa, Bauchi and Adamawa) of the country (Table 1). Majority of the cases occurred in turkey 10/17 (58.8%) flocks reared alone as compared with turkeys reared with other poultry species 7/17 (41.1%) flocks. HPAI introduction sources vary from the

introduction of new poultry species (geese and turkeys) from live bird market, to death of neighborhood poultry and extension to turkey flocks and/ or contact with free-range local chickens (Table 1).

DISCUSSION

HPAI outbreaks in turkeys affected mostly northern parts (Kaduna, Katsina, Nasarawa, Plateau, Taraba, Kano, Jigawa, Bauchi and Adamawa) of the country where most of the approximately 60 million of Nigeria's subsistence poultry are domiciled, and follows a pattern consistent with densely human populated cities of the north. Generally, poultry management system in Nigeria comprises intensive, extensive and semi-intensive; differentiated on the basis of flock size, input and output relationship (Sonaiya, 2005). It was observed that subsistence poultry especially turkey farming in Nigeria is largely and mainly semi-intensive as depicted by the findings of this study. Although, poultry farming including turkey rearing (Amo et al., 2014, Baba et al., 2014) in some parts of the country is largely rural and for subsistence, most often mixed with multiple species of poultry at different ages (Meseko et al., 2007) with the introduction of new birds to an existing stock as common practice (De Benedictis et al., 2007; Meseko et al., 2007). A large percentage of turkey production in different parts of the country is kept as either extensive or semi-intensive rearing (Amo et al., 2014, Baba et al., 2014). Although, intensive poultry production system has been practiced by some of the HPAI infected farms in the country, infected turkey farms investigated in this study practiced backyard, mixed species and free ranged system and occasionally, improvised housing are provided. Majority of the cases occurred in turkey flocks reared alone as compared with turkey reared with other poultry species flocks. HPAI introduction sources varies from the introduction of new poultry species (geese and turkeys) from live bird market to death of neighborhood poultry and extension to turkey flocks and contact with free-range local chickens (Table 1). The importance of the live bird markets in the spread of HPAI virus in Nigeria cannot be over emphasized (Fasina et al., 2009). Previous studies have similarly confirmed the role of wet markets, LBMs and movement of poultry and poultry products without recourse to biosecurity in the viral ecology and spread of avian influenza and other viruses (Guan et al., 2000; Henzler et al., 2003; Webster, 2004). Although some turkey flock owners did not report HPAI introduction source, it is likely that one or more of the above sources are responsible for the introduction of the disease in those flocks. It is obvious that the husbandry (subsistence, single, mixed multiple species) and the management system influenced the introduction of the virus and impacted on the effect of the disease. Because rural poultry are mainly kept in free-range, multispecies, multiage holdings that have low biosecurity levels and are thus exposed to many different sources of infection, they could act as the epidemiologic link between the wild reservoir of AI viruses and industrial poultry (Cecchinato et al., 2011).

Although no link to wild birds was established in this study, some of the affected states have wetlands and important bird areas within them and also, free-ranging poultry rearing system are being practiced. The lesions seen in the carcasses were consistent with HPAI and as reported earlier (Akanbi and Taiwo, 2014). The finding of this present study can be helpful for preventing HPAI infection in turkeys as it discourages introduction of newly purchased turkeys into existing flock from the open market and the rearing together of more than one species of poultry.

Table 1. Flock sizes and mortality rate distribution of single and mixed species of backyard Turkeys during Natural HPAI infection in Nigeria.

Location	Date	Flock sizes	Mortality	Rate	Species	HPAI Source
Kaduna	16.1.06	37,4,120	37,2,5	100,50,4	Turkey, geese, ostriches	Introduction of geese
Katsina Dutsen safe	13.2.06	2	2	100	Turkey	Introduction of local chickens for consumption from LBM
Nasarawa, Akwanga west	13.5.06	14	14	100	Turkey	Neighborhood poultry mortalities
Katsina	15.4.06	5	5	100	Turkey	Neighborhood poultry mortalities
Plateau, Jos north	8.5.06	86	49	56.9	Turkey	NA
Nasarawa Akwanga west	13.5.06	58,19,14	58,19,14	100	Chicken, duck, turkey	NA
Nasarawa Akwanga west	13.5.06	50,12,4	49,12,4	98,100,100	Chicken, duck, turkey	Neighborhood poultry mortalities
Taraba, Jalingo	19.7.06	2	2	100	Free-ranged turkeys	Neighborhood poultry mortalities
Kano. Ungogo LGA	5.12.06	350, 8, 6	18, 7, 4	5,87,5,66.6	Chicken, turkey, geese	Introduction of turkeys from LBM
Edo, Oredo, Benin	8.1.07	300, 200	300, NA	100, NA	Turkey, ducks, Free-ranged chickens	Free ranged Local Chickens
Jigawa, Dutse	9.2.07	28	17	60.7	Turkey	Neighborhood poultry mortalities
Jigawa, Dutse	9.2.07	1,8,28	1,2,17	100,25,60.7	Chicken, duck, turkey	Neighborhood poultry mortalities
Bauchi, maiduguri by-pass	11.2.07	-	-	-	Chicken, turkey	NA
Adamawa, Lamorde	18.2.07	5	5	100	Turkey	NA
Jigawa, Dutse	9.3.07	19	11	57.9	Turkey	Neighborhood poultry mortalities
Kaduna, Zongo	22.3.07	20	14	70	Turkey	Neighborhood poultry mortalities
Kaduna, Zongo	22.3.07	50	28	56	Turkey	Neighborhood poultry mortalities

NA: not available; LBM: live bird market

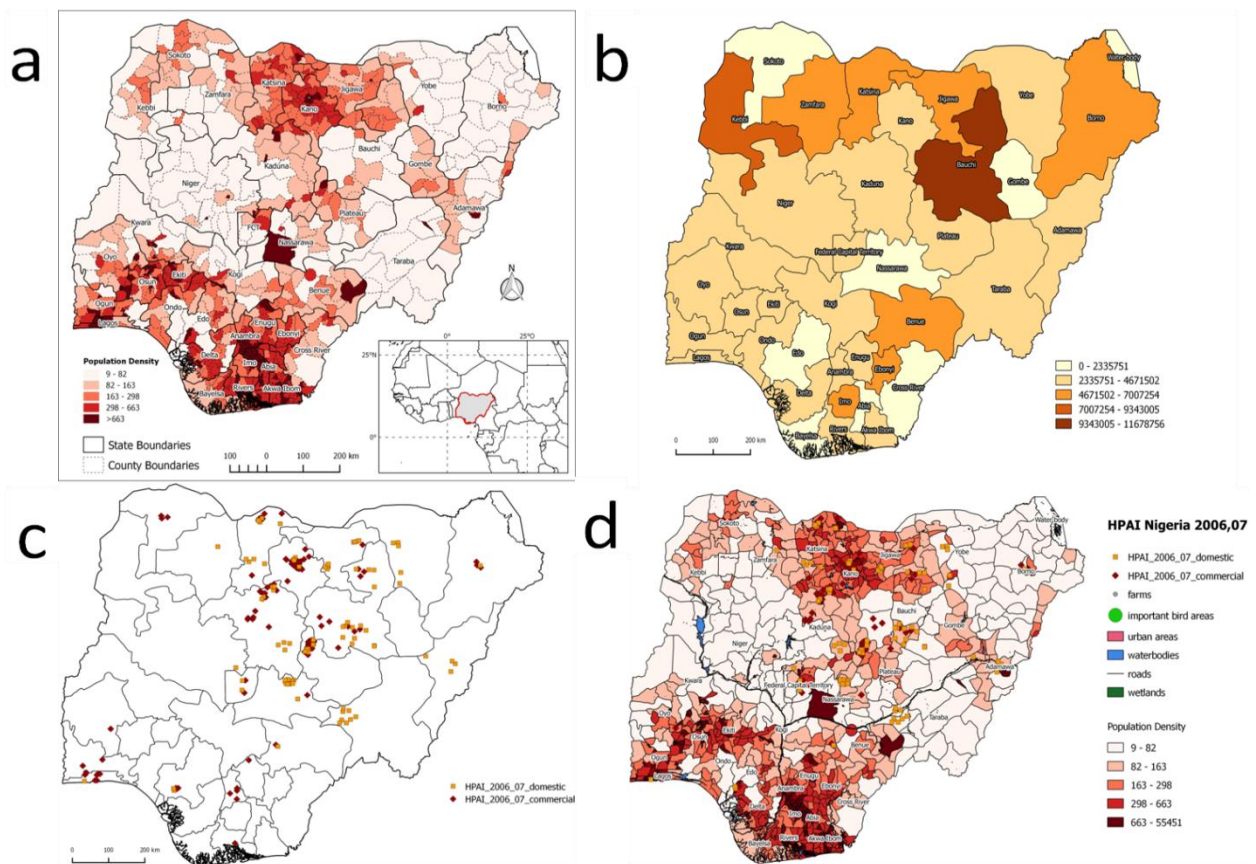


Figure 1. a: Human population density map of Nigeria, 2006; b: Poultry population density map of Nigeria, 2006; c: spatial map of HPAI H5N1 positive cases in domestic and commercial poultry in Nigeria; d: spatial map of HPAI H5N1 positive locations in Nigeria against human population. [*The maps were created using the data from the NBS, 2006 and the tables of distribution of poultry in Nigeria Adene and Oguntade, 2006 and FAO 2008.]

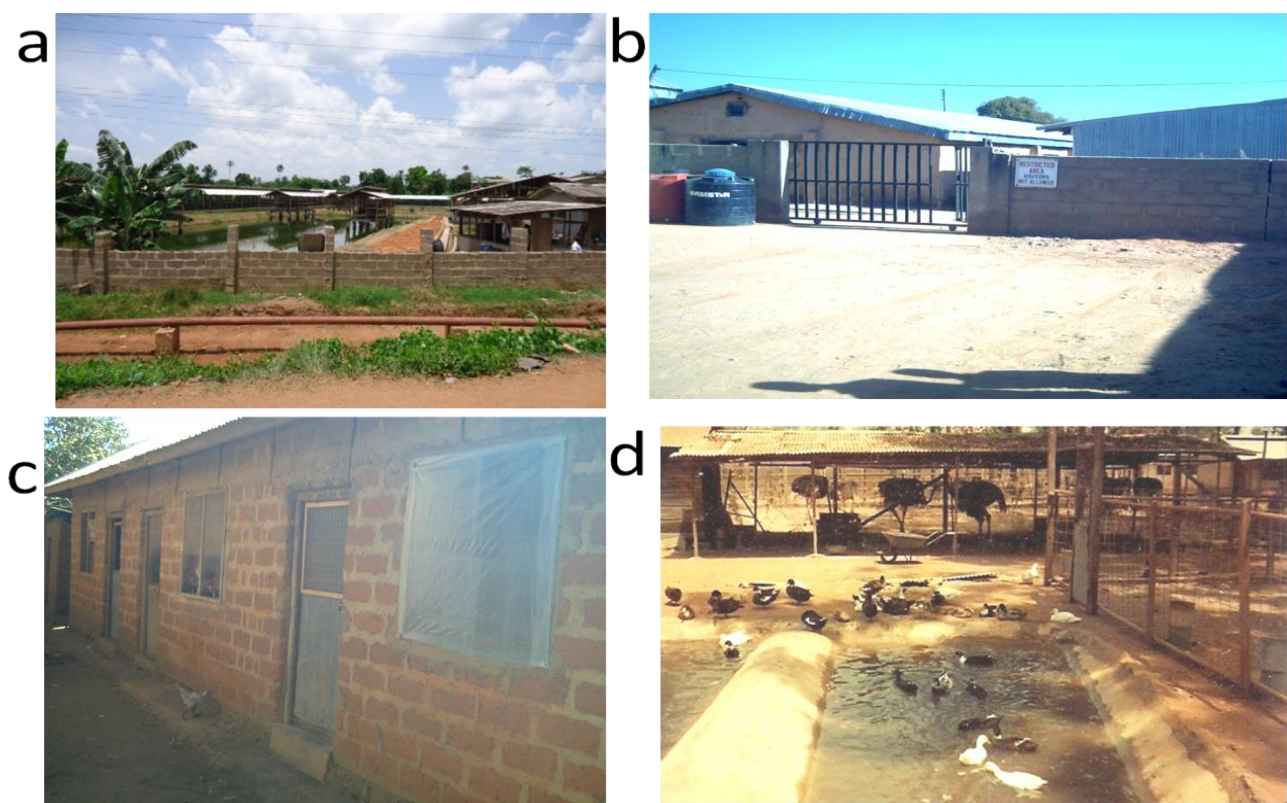


Figure 2. a: Intensive poultry production system in the tropics; b: Intensive poultry production system in the tropics with biosecurity provision; c: Semi-intensive backyard poultry production system; d: Mixed species (ducks, geese and ostriches) backyard poultry production system in Nigeria before the introduction of HPAI.

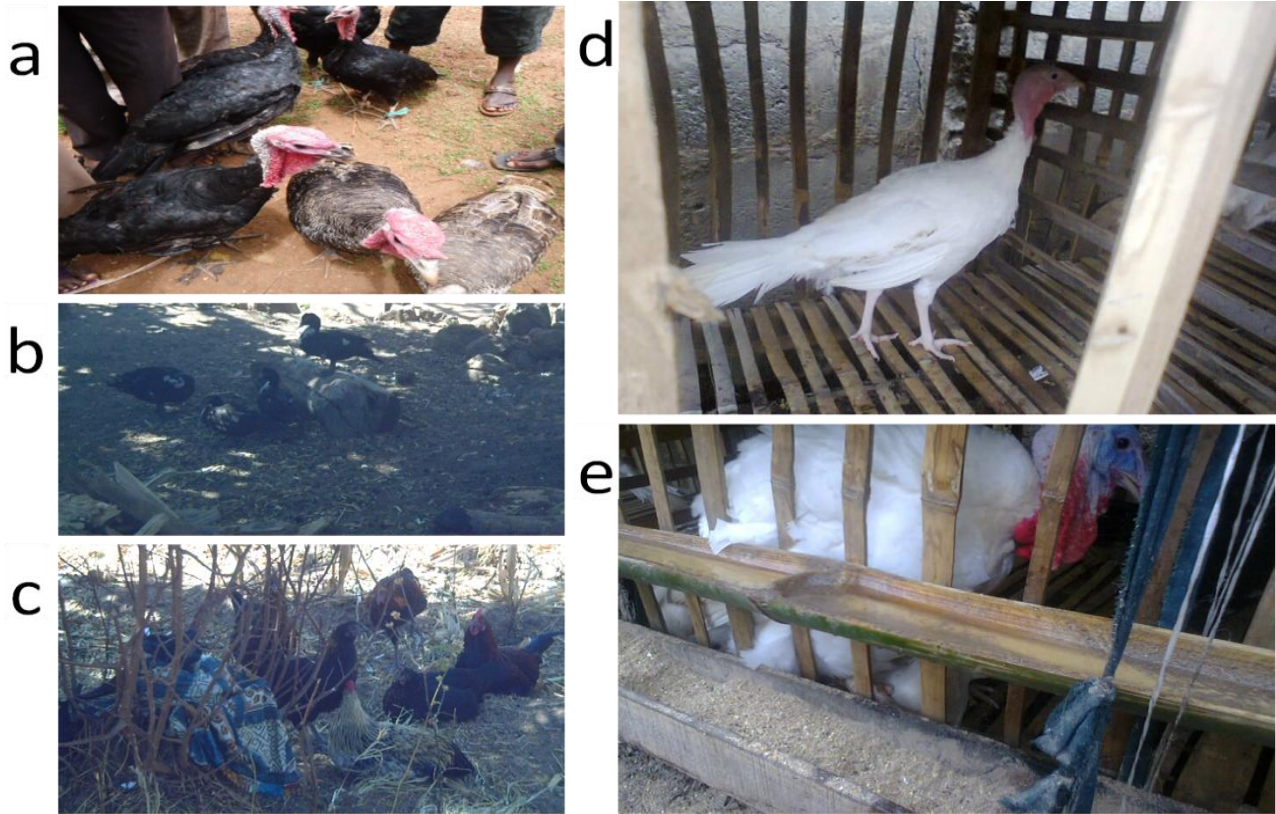


Figure 3. a: free range- poultry production system, black and lavender cross turkeys; b: free range- poultry production system, Mallard and Muscovy cross ducks; c: free range- poultry production system, subsistence indigenous chicken; d and e: Semi-intensive backyard poultry production system, white British United Turkeys (BUT) with improvised bamboo housing.

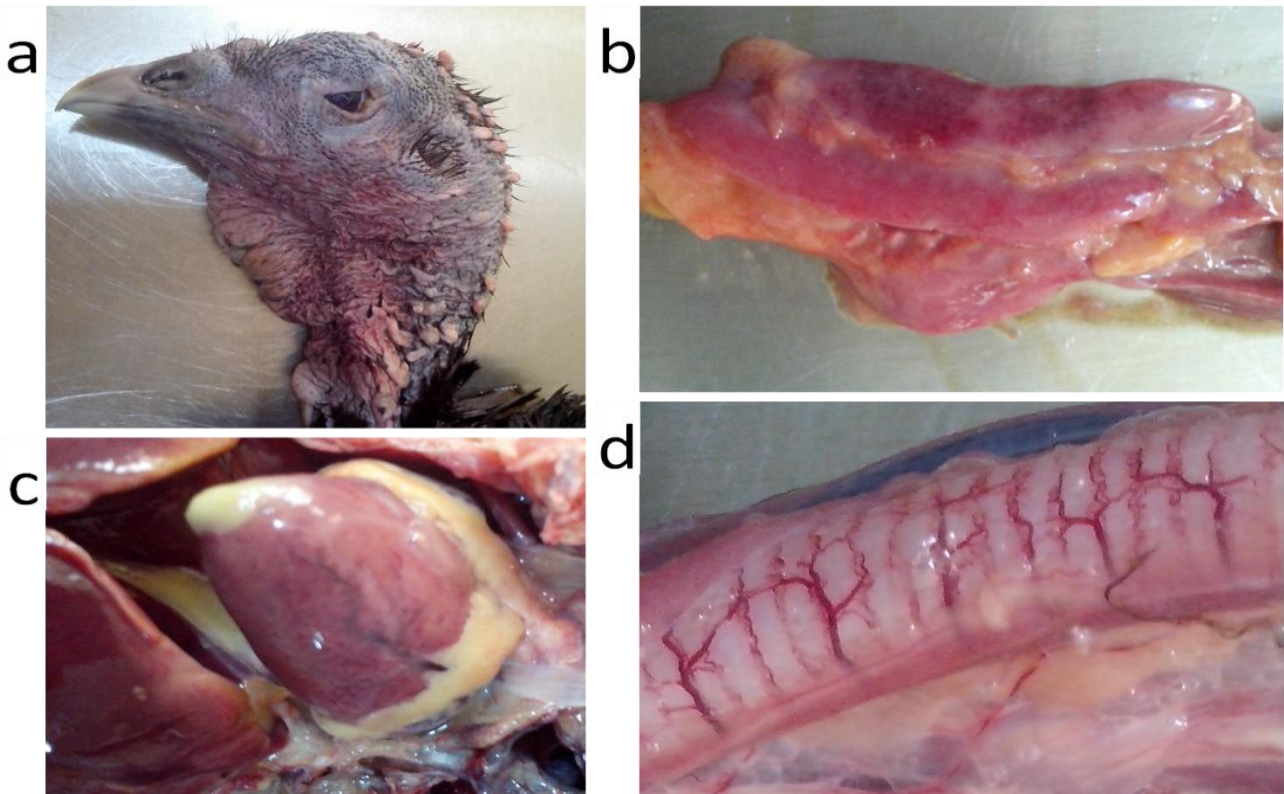


Figure 4. Some lesions seen at postmortem examination in turkey caused by highly pathogenic avian influenza; a: wattle hyperemia; b: petechiation in pancreas; c: heart with petechiation of the myocardium; d: vascular congestion of trachea.

CONCLUSION

It is hoped that the findings of this study will help to control future outbreaks of HPAI within Nigeria and in other countries with similar husbandry practices.

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