ISSN 0189-0514
J. Anim. Prod. Res. (2018) 30(1):301-310

National Animal Production Research Institute
Ahmadu Bello University
P.M.B 1096, Shika-Zaria,
Kaduna State, Nigeria.
Email:japr@napri.gov.ng Url:journals.napri.gov.ng

ASSESSMENT OF EFFECTS OF BIRD FLU ON POULTRY PRODUCTION IN IKORODU LOCAL GOVERNMENT AREA OF LAGOS STATE

[1]Bello, K. O., [2]Oyeleke, O. T., [3]Irekhore, O. T., [1]Oyedepo, J. A. and [4]Adetoye, A. M.
[1]Institute of Food Security, Environmental Resources and Agricultural Research, Federal University of Agriculture, Abeokuta, Nigeria
[2]Department of Animal Production and Health, Federal University of Agriculture, Abeokuta, Nigeria
[3]Agricultural Media Resources and Extension Centre, Federal University of Agriculture, Abeokuta, Nigeria
[4]Department of Agricultural Economics and Farm Management, Federal University of Agriculture, Abeokuta, Nigeria

ABSTRACT

Food safety issues and the likely challenge on poultry products in domestic and inter nationally markets are pertinent issues in the food supply chain thus the need for regular surveillance and policy evaluation. This study was conducted between March and April 2015 to determine the shock of Avian Influenza (AI) in Ikorodu Local Government Area (LGA) of Lagos State, Nigeria. The assessment was done on 33 farms with the aid of structured questionnaire through a purposive and sampling technique followed by a snow ball method. Data were collected on the demographic characteristics, production, and market activity of the farms, to assess the outbreak effect of AI. Data were analyzed using descriptive and t-test statistics. Result revealed that the oldest farm in Ikorodu LGA was established about 17years. The farms had average of 8 years of establishment, 7 staff, and a farm size of 6884 birds. Of the entire farm size, layer was the main (48.48%) chicken type reared in the study area. There was no significant ($p>0.05$) change in prices of chick, grower mash, spent layer, point of cage, point of lay and eggs of different sizes before and after the announcement of AI, except for breeder mash which reduced ($p<0.05$) from ₦2343 to ₦2299 per bag. The study concluded that the poultry farms in Ikorodu LGA were not affected by avian influenza as at the time of announcement. Poultry farmers were advised to uphold structural and operational biosecurity measures in high esteem.

Keywords: Poultry birds; Avian influenza, Ikorodu, Lagos

INTRODUCTION

Avian influenza (AI) also known as bird or avian flu is an infectious disease of birds caused by type A strain of the influenza virus (WHO, 2008). Highly Pathogenic Avian Influenza (HPAI) is caused by avian influenza virus subtype H5N1s and is responsible for the most terrible veterinary health crisis ever recorded in poultry production world-wide (Alexander, 2003; Deogu *et al.*, 2003; Ligon, 2005; Adene *et al.*, 2006). HPAI is highly deadly, thus the one health care authorities are most concerned about. Avian flu affects several types of birds, including poultry birds like chickens, geese, turkeys and ducks (Ligon, 2005).

According to UNICEF (2008), AI is characterized by respiratory, reproductive, digestive and or nervous signs. Affected birds often show severe depression, sudden drop in egg production, respiratory problem, swollen combs, wattles, shanks and sudden death. The virus has an incubation period of few hours to

days and mortality rate can reach up to 90-100%, often within 48hours of showing clinical signs. The avian influenza virus is present in secretions and excretion of infected birds. It is transmitted either by directly breathing of contaminated air and dust or indirectly via ingestion of contaminated water, feeds or infected carcasses and particularly where biosecurity measures (both operational and structural) are lacking. This is attributed to the movement of infected birds, feeds, personnel, equipment and vehicles into and out of contaminated premises (Bawa *et al.,* 2004)

The first outbreak on the African continent was reported in Nigeria on February 8, 2006 in domestic poultry. Three months later, some other African countries (Egypt, Niger, Cameroon, Burkina Faso, Sudan and Côte d'Ivoire) were also infected. In 2007, three Western African countries (Ghana, Togo, and Benin) became infected while outbreaks were repeatedly reported in Egypt and Nigeria (EPIAAF, 2008).

The first case of AI in Lagos State was reported in February 2007 but later spread to 26 farms by the end of the year (Lagos State Government Ministry of Health, 2016). In 2015, there was pronouncement of AI in live bird market in Lagos (Sahara Report, 2017). Since the first national occurrence in 2005, the Government of Nigeria developed a National Emergency Preparedness and Response Plan (NEPRP) actions for the prevention and control of the disease. This is due to huge economic losses ascribed to the disease in terms of trans-boundary spread and trade limitation (Newton and Kuethe, 2015). Timothy *et al.* (2011) reported that AI was a major cause of economic challenges in poultry production in Nigeria. The implications could be true on Lagos State as well as Ikorodo Local Government Area (LGA).

Ikorodu Local Government Area (LGA), by location is susceptible. Ikorodu is a fast developing urban centre with estimated population of about 535,619 growth rate of 8.89% (Oyewole, 2011; ikoroduoga.net; The World Gazetteer, 2013). The LGA location along Lagos Lagoon necessitated the need for increased surveillance in the LGA particularly as ducks and other water loving poultry have been identified as one of major infection attraction of AI.

Hitherto, untreated surface water in farms was considered as a short and long-term source of AI viruses for domestic birds (Hinshaw *et al.*, 1979; Halvorson *et al.*, 1985) and as the most significant risk factor to the occurrence and transmission of AI (H5N1 strain) in the commercial poultry farms (Ligon, 2005). The possible risks could be run-off from infected premises into surface or ground water and through ditches downstream to another uninfected premise (Cardona, 2007).

Incidence of AI could have effect on human and public health, and eventual human death as had been reported in some African countries. The need for concerted efforts to prevent the economic losses and other hardship, stop the spread of the bird flu disease and prevent the transmission to humans is therefore, of significant importance. Also, the need for regular surveillance, data gathering and evaluation for policy development cannot be over emphasized. In view of the past experience of the year 2005 to 2007, there is need to assess the current trend of avian influenza in Ikorodu Local Government Area, Lagos State for monitoring and in support of food security initiative of the Government. Similarly, the negative socio-economic impact of AI, apart from the public health significance are reasons for regularly surveillance and monitoring of the disease, thus the need for this study.

MATERIALS AND METHODS

The study was conducted in Ikorodu Local Government Area, Lagos State. The area is located along the Lagos Lagoon (Figure 1). It shares a boundary with Ogun State. As of the 2006 Census, Ikorodu had an enumerated population of 535,619, with a land area of 394

km^2 (ikoroduoga.net; The World Gazetteer, 2013).

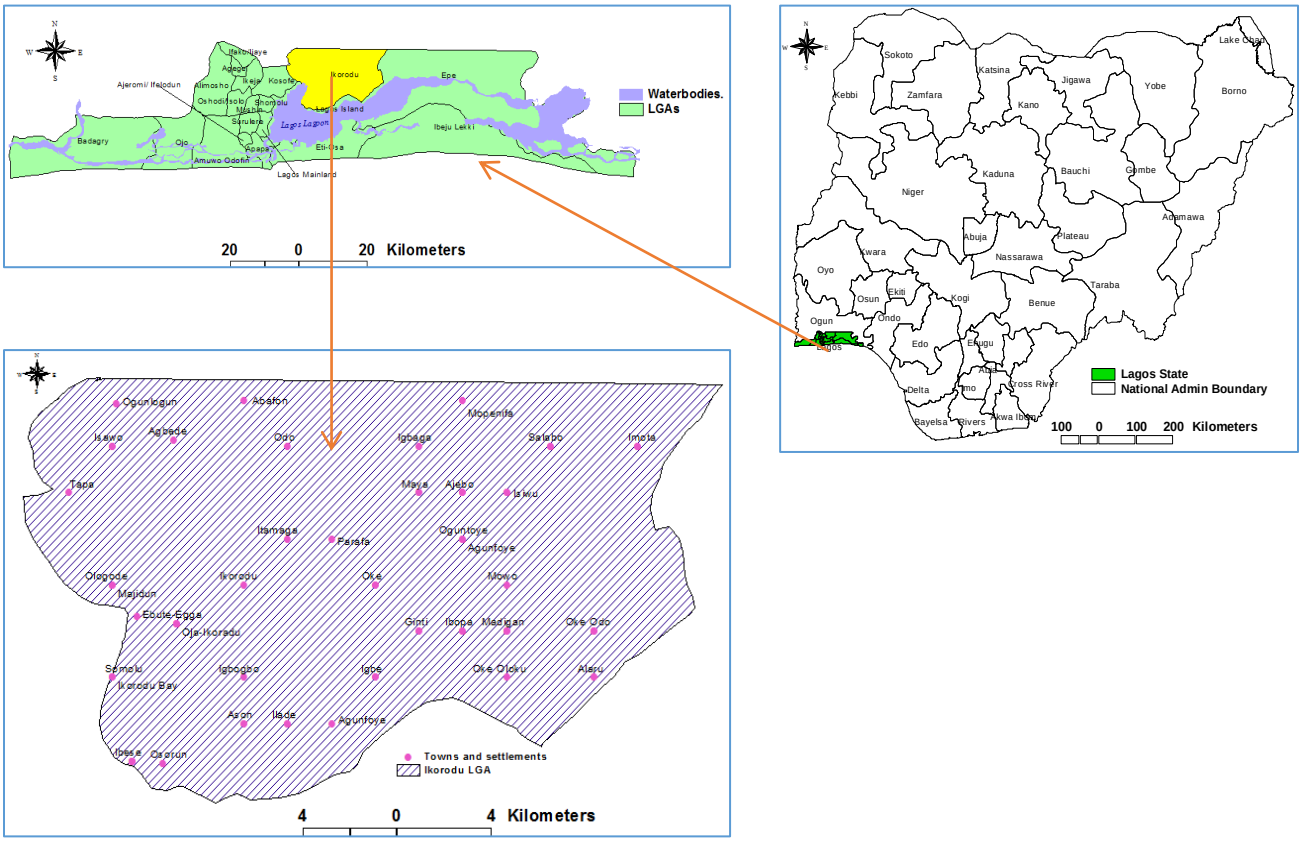


Figure 1: Map of Ikorodu showing selected settlements (Inset: Top right Map of Nigeria showing location of Lagos State; Top left Map of Lagos showing Ikorodu LGA)

Source: IFSERAR GIS Laboratory

A purposive sampling technique was used. The location was purposively selected because of the good concentration of poultry farms and farmers in the area. There was no record of registered poultry farmers, hence, the study only ensures a selection of minimum sample of thirty-three poultry farms through a snowball method. In snow ball procedure, the location of other poultry farmers was made possible with the help of first farmer that was interviewed and subsequently through other identified farmers.

Primary data were collected through a personally administered structured questionnaire on effect of avian influenza in the area. Ex-ante and post-ante information of the avian influenza outbreak was captured based on number of staff, number of birds, price of feeds, prices of birds, price of egg, number of morbidity, and number of mortality with the aid of the questionnaire. In addition, data on age of farms in the study area and problems associated with incidence of avian influenza were gathered. The data were subjected to descriptive and t-test statistics.

RESULTS AND DISCUSSION

Table 1 shows the demographic characteristics of poultry farms in Ikorodu Local Government

Area. Age of poultry farms in Ikorodu Local Government Area of Lagos State range between 2 and 17years. This is an implication of age long contribution of poultry to employment in Nigeria. Though, there is no clear evidence of the genesis of poultry rearing in Nigeria, Oyediji (2010) opined that poultry production (Chicken, Duck, Guinea Fowl, Turkey etc.) has been part of many cultures and are reared for food, income and other domestic needs. It has been source of employment and income generation even in the Old Western Region of Nigeria in the 1950's when Breeder farms and hatcheries (Iwo Oloba hatchery for instance) were established to supply Day Old Chicks to farmers and the Farm Settlement Scheme where poultry, other livestock and crops are produced. This similarly emphasized that Poultry business has been a long-time business in Western Nigeria which, as a matter of facts, includes Ikorodu Area of Lagos State. Poultry practice spanned through the period of Operation Feed the Nation of 1978 to other agricultural programmes of the Nigerian Government in which it plays a prominent role. Therefore, a 17year age result for some of the farms in Ikorodu Area, Lagos State, Nigeria was not an aberration.

The highest and lowest staff population were 8 and 1, respectively. An average staff population of the poultry farm in Ikorodu was 7. This indicates the importance of poultry business in job creation and employment generation for the Nigerian teeming population. Timothy *et al.*, (2011) stated that poultry has potential to create job. Their report gave credence to this finding. By extrapolation, increase in the establishment of more poultry farm with estimated average production capacity of about 6,884 would result in direct job creation for about 7 million excluding other actors in the value chain. Therefore, poultry business could be explored in the desire to boost the country Gross Domestic Product.

The farm size was estimated at an average of 6,884. Of all the farm visited, the largest farm has a total of 8,714 bird while the least has about 200 birds. Most of the farms were of medium scale farmers. Scale of production usually indicates the extent for the need of bio-security which is mostly considered less required in most small and medium scale farmers and thus hitherto lacking (Timothy *et al.* 2011). This was not unexpected following the fact that Nigeria had chicken population of over 160 million in 2006 and commercial poultry represented over 25% of this population. This also emphasize the importance and contribution of chicken to the Nigerian food security (Timothy *et al.*, 2011; Bello *et al.*, 2015) and global food security (FAO, 2011).

Table 1: Demographic Characteristics of Poultry Farms in Ikorodu Local Government Area

Parameters	Maximum	Minimum	Average	Total Population
Age of the Farm (Years)	17	2	8	33
Staff Population (no)	8	1	7	33
Number of Birds	8714	200	6884	33

Source: Computed from Field Survey, 2015

Figure 2 shows the types of birds reared by the poultry farmers in Ikorodu Local Government Area. Layers represented about half (48.48%) and thus represent the most reared type of birds in the area. None of the poultry farms reared only cockerel. Less than one-tenth (6.06%) of the respondents reared broiler and cockerel, 18.18% reared cockerel and layers, and 12.12% reared broiler, cockerel and layers. The fact that layers is the most reared type of birds in the

study area corroborates the view of Oyeyinka *et al.* (2011) and Bello *et al.* (2015), who reported that keeping layers is more profitable to the farmers than keeping broilers, cockerels and others. This could also be attributed to the fact that eggs have no substitute as cheap protein source and a better protein quality with high biological value which is found and sold at any local and modern sales outlets. This could be responsible for the edge that layer has over other chiken types. Equally, while meat-type chickens (Broilers and cockerels) sales and prodution are season and festive periods dependent, layers products (meat and egg) serves as source of regular income to the farmers.

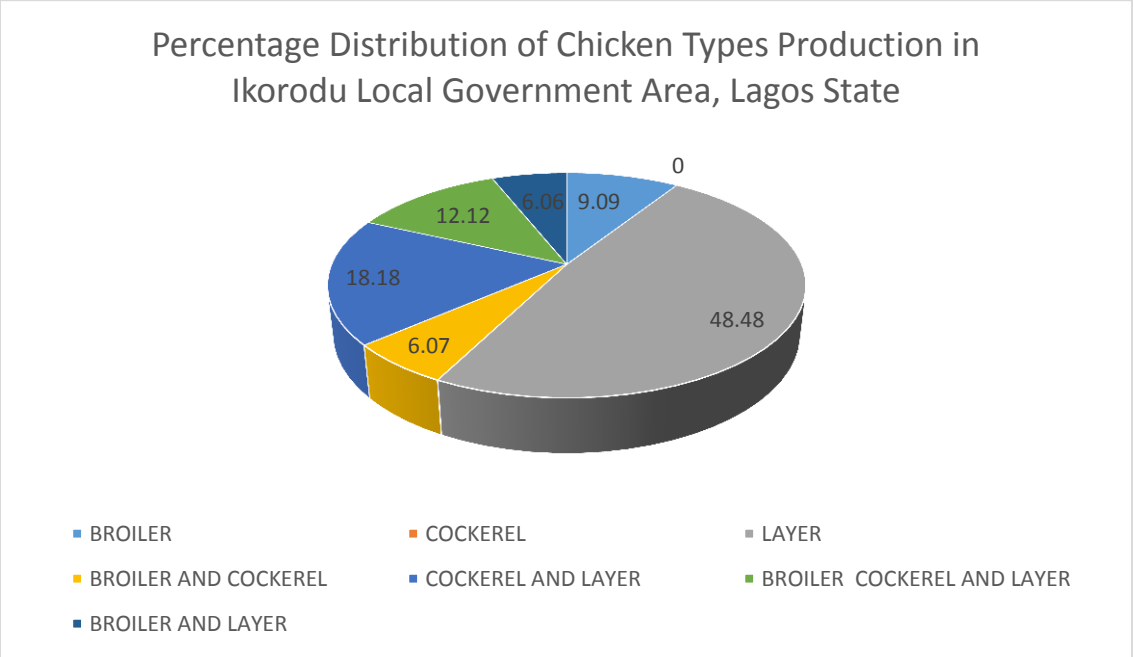


Figure 2: Types of Birds and Percentage Distribution Reared in Poultry Farms in the Study Area

Table 2 shows that 81.81% of the respondents recorded mortality within six weeks prior to the survey. However, the cause of the mortality was not as a result of AI but due to diseases such as; samollena, chronic respiratory disease, coccidiosis as indicated in the post mortem result findings. An important feature of AI epidemic and the virus is the wide range of species of birds infected (Perkins and Swayne, 2003) but there was none in this case. For example, when AI was reported in Nigeria on the 14th of January, 2006 (Adene *et al.*, 2006), it was simultaneously, though independently confirmed by the OIE world reference laboratory at Padova, Italy on the 7th of February, 2006. Despite immediate containment measures taken by the veterinary and public health authorities in conformity with standard operation procedures, the disease still spread to 14 states and 26 local governments (NADIS INFO, 2006). The experience of 2005-2007 has not occurred in the study area and neighbouring towns. This probably suggested there was no occurrence of bird flu at this period or there has been improvement in operational and structural bio-security practices of farms in the study area. Also, there was no evidence of untreated surface water which was considered to be the most significant risk factor likely to contribute to the occurrence of AI in the commercial poultry farms as opined by Ligon (2005) in the farms visited. Issue of untreated surface water could had probably been improved upon as part of bio-security measures in the study area. Better knowledge and awareness of the disease prevention could also have been due to the campaign on avian influenza by the control

programme in Nigeria (AICP, 2009; Dairo and Elelu, 2013).

Table 2: Mortality records of poultry farms in Ikorodu LGA between January and May 2015

Parameters	Frequency	Percentage (%)
Yes	27	81.81
No	6	18.19
Total	33	100.00

Source: Computed from Field Survey, 2015

Table 3 shows economic indicators which had been used to determine influence of AI on poultry production. Some of the indicators were prices of different poultry input and output types such as price of feed, sale price of egg, reduction in staff population (staff retrenchment) etc. within a period of 12 weeks (6 weeks before and after the outbreak of avian influenza). Results revealed that prices per bag (25kg) of chick, layer and breeder mash were unchanged. Price per bag of starter and grower mash decreased by 1.06% and 14.37%, respectively, while price per bag of broiler finisher increased by 1.09%. This result revealed a relative stable market for poultry major input (feed) which represent about 65% of cost of production. This could be a pointer to that fact that there was no incidence of AI in Ikorodu and its environs as at the time of this study.

Table 3 also shows the prices of different types of birds and different sizes of egg sold by the respondents six weeks before and after the announcement of avian influenza. Price of spent layer increased by 1.99%. Price of giant broiler and point of cage increased by 2.31%. Prices of cockerel and point of lay increased by 3.55% and 1.8%, respectively. Similarly, price per crate of large, medium and small size eggs increased by 1.51, 0.83 and 0.57%, respectively. AI had been reported world-wide in distribution with a negative socio-economic impact apart from the public health significance. HPAI is a devastating disease in poultry; it is associated with a high death rate and disrupts poultry production and trade with huge reduction in prices of inputs and outputs (Alexander, 2003; Senne, 2003; Alexander, 2004; FAO, 2005). However, none of these characteristics had been displayed or indicated in any of the parameters measured. This could also be a pointer to the fact that there was no occurrence of AI in the study area and no need for anxiety and panicking by farmers.

Table 3: Economic Indicators of HPAI in Ikorodu LGA between January and May 2015

Parameters	Cost 6weeks before Avian Influenza announcement (₦)	Cost 6weeks after Avian Influenza announcement (₦)	Percentage Change (%)
Bag of chick mash (25kg)	2427.00	2427.00	0.00
Bag of grower mash (25kg)	2176.61	1863.83	14.37*
Bag of layer mash (25kg)	2317.00	2317.00	0.00
Bag of breeder mash (25kg)	0.00	0.00	0.00
Bag of starter mash (25kg)	2616.00	2588.00	1.07*
Bag of broiler finisher (25kg)	2448.00	2475.00	1.10**
Spent layer	871.00	888.00	1.95**
Giant Broiler	2525.00	2528.00	0.12**
Cockerel	1536.00	1591.00	3.58**
Point of cage pullet (12weeks)	1083	1108	2.31**
Point of lay pullet	1129.00	1150.00	1.86**
Crate of egg (large)	648.00	651.00	0.46**
Crate of egg (medium)	562.00	566.00	0.71**
Crate of egg (small)	463.00	470.00	1.51**

Source: Computed from Field Survey, 2015. *, ** represents increase and decrease respectively

Table 4 shows market price of some poultry inputs and outputs in Ikorodo Local Government Area of Lagos between January and May 2015 following announcement of bird flu outbreak in the area. Prices of some selected inputs that were monitored before and after the outbreak report had no significant ($p>0.05$) relationship except ($p<0.05$) price of breeder mash. This result was in order as majority of the farms visited were commercial egg producing farms. Oyeyinka *et al.* (2011) reported that majority of the poultry farmers reared layers. The report gave credence to the finding of this study. Furthermore, selling prices of primary outputs (point of lay birds, old/spent layers, broiler chicken, and egg of different sizes) were not significantly influenced ($p>0.05$) by bird flu infection announcement. In 2006 and 2007, when there was bird flu, prices of these products crashed and there was high supply-demand gap that led to reduction in prices of these primary product (Timothy *et al*., 2011). The result of Timothy et al., 2011 was similar with that of Newton and Kuethe (2015). However, variance in the observations as recorded in this study could be attestion to non indidence or that poultry faremrs are more biosecuity conscious to prevent bird flu occurece in Ikorodo Area of Lagos. This may probably be influenced by year of experience in the business and masive orientation programme of the Government as well as the Authority of Poultry Association in the State and Area as majority of the poultry farms started more one and half decade ago.

Table 4: Market price indicators of some poultry inputs and products between January and May 2015 announcement of Avian Influenza in Ikorodu local Government Area, Lagos State

Parameters	Before the Outbreak	After the Outbreak
Mortality (%)	0.92 ± 0.29	0.17 ± 0.39
Price of Chick Mash (₦/bag)	2473.13 ± 158.09	2473.13 ± 158.09
Price of Grower Mash (₦/bag)	2473.13 ± 158.09	2473.13 ± 158.09
Price of Layer Mash (₦/bag)	2475.73 ± 158.82	2133.92 ± 173.29
Price of Breeder Mash (₦/bag)	2343.33 ± 125.87[a]	2298.58 ± 40.37[b]
Price of spent layer (₦/b)	835.42 ± 52.72	850.35 ± 41.76
Price of Cockerel (₦/b)	1522.47 ± 176.06	1503.87 ± 162.91
Price of Giant Broiler (₦/b)	2318.75 ± 256.98	2272.92 ± 152.05
Price of Point of Lay (₦/b)	999.44 ± 109.97	999.42 ± 111.61
Price of crate of Large size egg (₦)	645.56 ± 34.51	649.17 ± 32.51
Price of crate of medium size egg (₦)	559.22 ± 35.43	568. 22 ± 31.43
Price of crate of small size egg (₦)	455.37 ± 33.52	462.97 ± 32.39

ab: means within the same row with different superscript differed significantly ($p<0.05$)

CONCLUSION

From the study findings, the prices of feeds, birds and different sizes of egg were not affected by the outbreak report of AI infection in Ikorodu Local Government Area. This implied there were no confirmed or pronounced cases of avian influenza in the area. Poultry farmers in Ikorodu Local Government Area could be said to be well informed of the biosecurity measures being the third time of the outbreak in Nigeria. Poultry farmers were implored to hold-up structural and operational biosecurity measures in all their farms in high esteem to prevent disease occurrence.

REFERENCES

Adene, D. F., Wakawa, A. M., Abdu, P. A., Lombin, L. H., Kazeem, H. M., Sa'idu. L., Fatihu, M. Y., Joannis, T., Adeyefa, C. A. O. and Obi, T. U. (2006). Clinico-pathological and Husbandry Features Associated with the Maiden Diagnosis of Avian Influenza in Nigeria. *Nig. Vet. J*., 27: 32-38

Alexander, D. J. (2003). Reports of Avian Influenza in the Eastern Hemisphere during 1997-2002. *Avian Dis*., 47: 792-797.

Alexander, D. J. (2004). Avian Influenza: Recent development. *Avian Path*., 33: 393-404.

Avian Influenza Control Programme (AICP), (2009). Bird flu watch. Publication of Nigeria's AI control and pandemic preparedness and response project (AICP), 2009 February Vol.1 (1):7

Bawa, G. S., Balogun, T. F., Ega, L. and Omage, J. J. (2004). Urban Backyard swine production: A case study of Kaduna, A

Nigerian metropolitan city. *Nigeria Journal of Animal Production*, 32(2): 237-244.

Bello, K. O., Alebiosu, L. A., Lala, A. O., Irekhore, O. T. and Oduguwa, O. O. (2015). Characteristics of commercial poultry and spatial distribution of metabolic and behavioural diseases in Oyo State, Nigeria. *Sokoto Journal of Veterinary Sciences* 13(3):31-41.

Cardona, C. J. (2007). Recommendations to prevent the spread and/or introduction of avian influenza virus. www.vetmed.ucdavis.edu/vetext/INF-PO_AI- Recommendations.pdf, retrieved 2007-04-06.

Dairo, M. D. and Elelu, N. (2013). Knowledge and preventive practices related to avian influenza among livestock farmers and poultry traders in Ikorodu, Lagos state, Nigeria. *Journal of Public Health and Epidemiology*. 5(4): 202-207. DOI:10.5897/JPHE10.028. ISSN 2006-9723 Academic Journals http://www.academicjournals.org/JPHE

Deogu, M., De Marco, M. A., Donatelli, I., Campitelli, I. and Catelli, E. (2003). Ecological aspects of influenza: A virus circulation in wild birds of the western paleartic. *Veterinary Research Communications*, **27**(1): 101-106.

Ducatez, M. F.; Olinger, C. M.; Owoade, A. A.; De Landtsheer, S.; Ammerlaan, W.; Niesters, H. G.; Osterhaus, A. D.; Fouchier, R. A. and Muller, C. P. (2006). "Avian flu: multiple introductions of H5N1 in Nigeria. *Nature* 442 (7098): 37.

Epidemiology of Avian Influenza in Africa (EPIAAF) Survey (2008). Final report LoA PR 37212 between FAO and CIRAD. UPR 22 Animal et Gestion intégrée des risques TA C-22/E Campus international de Baillarguet. 34398 Montpellier cedex 5 France.

Food and Agricultural Organization of the United Nation (FAO), (2005). Epidemiology of H5N1 Avian influenza in Asia and implications for Regional control. Morris, R.S. and R. Jackson (Eds.). Rome, Italy.

Food and Agricultural Organization of the United Nation (FAO), (2011). *World Livestock 2011*. Livestock in Food Security. FAO of the United Nations, Rome. Pp 130

Halvorson, D. A.; Kelleher, C. J. and Senne, D. A. (1985). Epizootiology of avian influenza: effect of season on incidence in sentinel ducks and domestic turkeys in Minnesota. *Applied and Environmental Microbiology*, 49 (4): 914-919.

Hinshaw, V. S.; Webster, R. G. and Turner, B. (1979). Water-borne transmission of avian influenza viruses? *Intervirology*, 11 (1): 66-68.

Ligon, B. L. (2005). Avian influenza virus H5N1: a review of its history and information regarding its potential to cause the next pandemic. *Semin Pediatr Infect Dis*; 16:326–335

National Animal Disease Information and Surveillance (NADIS INFO), (2006). Special "Avian Flu" Edition. 9th Edn. May, 2006. Pan-African Control of Epizootics (PACE) project, Nigeria. Pp: 1-3.

Nweton J. and Kuethe T. (2015). Economic Implications of the 2014-2015 Bird Flu. *farmdoc daily* (5):104, Department of Agricultural and Consumer Economics, University of Illinois at Urbana-Champaign, June 5, 2015. http://farmdocdaily.illinois.edu/2015/06/economic-implications-of-the-2014-2015-bird-flu.html

Oyediji, G. O. (2010). Animal Science Practice in Nigeria during the Colonial Era. Animal Science Practice in Nigeria. Revised Edition 2010. Pp 11-19. Published by Animal Science Association of Nigeria. ISBN: 978 978 48066 6 4

Oyeyinka, R. A., Raheem, W. K., Ayanda, I. F. and Abiona, B. G. (2011). Poultry farmers' awareness and knowledge of improved production practices in Afijio Local Government Area, Oyo State, Nigeria. *Journal of Agricultural Research and Development*, 1(1):1-8. Available online http://www.e3journals.org/EJARD © E3 Journals 2011.

Perkins, L. E. L. and Swayne, D. E. (2003). Comparative susceptibility of selected avian and mammalian species to a Hong Kong-origin H5N1 high pathogenicity avian influenza virus. Avian Dis., 47: 956-967.

Senne, D. A. (2003). Avian influenza in the Western Hemisphere including the pacific Islands and Australia. *Avian Dis*., 47: 798-805.

Statistics Package for Social Science (SPSS), (2006). Spss 16.0 for windows. Spss Inc Chicago

Squarzoni, C., Bastiaensen, P. *et al.* (2006). "La grippe aviaire en Afrique subsaharienne: unpremier bilan." Proceedings AEEMA, Liège, Belgique, 18-19 mai 2006.

The World Gazetteer, (2013). http://www.world-gazetteer.com/wg.php?men=gpro&des=gamelan&geo=347814351

Timothy, U. O., Olubukola, A. and Garba, A. M. (2011). *Pro-Poor HPAI risk reduction strategies in Nigeria —background paper*. International Food Policy Research Institute (IFPRI). Africa/Indonesia Region Report No.5. Pp115.

United Nations Children's Fund (UNICEF), (2008). Avian Influenza Media Kit. http://www.unicef.org/nigeria/ng_publications_AImediakit.pdf

World Health Organisation (WHO), (2006). Avian Influenza, February 2006. Available at http://www.who.int/mediacenter/factsheet/avian_influenza/en/index.html. Retrieved 16 Feb. 2009