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Article *in* Sokoto Journal of Veterinary Sciences · April 2022

DOI: 10.4314/sokjvs.v20i1.9

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Sokoto Journal of Veterinary Sciences

(P-ISSN 1595-093X: E-ISSN 2315-6201)

http://dx.doi.org/10.4314/sokjvs.v20i1.9

Bitrus *et al.*/*Sokoto Journal of Veterinary Sciences*, **20**(1): 63 - 66.

Seroprevalence of avian leukosis virus in local chickens in five live bird markets, Kaduna metropolis, North-western Nigeria

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Publication History:
Received: 09-09-2021
Revised: 03-08-2021
Accepted: 11-08-2021

Abstract

Avian leukosis virus is recognized as an important viral pathogen in the poultry industry, resulting in salient severe economic losses due to reduced production, uneven flock growth rates, reduced growth, and immunosuppression which predispose affected birds to other infections. This study examined the seroprevalence of avian leukosis virus (ALV) in local chickens (LC) in 5 different live bird markets (LBMs) in Kaduna Metropolis. A total of 276 sera were tested for ALV p27 antigen using enzyme-linked immunosorbent assay (ELISA). An overall seroprevalence of 28.3% (78/276) was recorded in the study. At the market level, the seroprevalence of 35% (21/60), 30% (18/60), 32% (16/50), 28.6% (16/56), and 14% (7/50) were recorded for Sabon Tasha, Central market, Railway station, Kawo and Sokoto Road LBMs respectively. With regards to sex, female LC showed a significantly higher prevalence of 30.5% (46/105) compared to male chickens 26.9% (46/171) with no significant difference ($P > 0.05$) observed. This study established the presence of antigen to ALV in local chickens sold in LBMs. We recommend surveillance and further studies on the isolation, molecular characterization and pathogenicity of ALV in the study area.

Keywords: Avian leukosis virus (ALV), ELISA, Live Bird Markets, Local chickens, Seroprevalence

Introduction

Nigeria has the second-largest chicken population in Africa after South Africa with about 180 million birds. Of these birds, 78 million are raised in the extensive (free-range) system; the free-range and backyard husbandry system is mostly practised for village chicken production which serves as a source of food and financial support in many households (Sultana *et al.*, 2012; FAO, 2018). Generally, rural women raise backyard poultry to provide additional economic assistance to their families (Sultana *et al.*, 2012). Diseases including avian leukosis (AL) have been documented as one of the major challenges

confronting local backyard chicken production aside from the issues of poor housing, the low genetic potential of the rural poultry and feeding (Saidu *et al.*, 1994). Avian leukosis (AL) is usually unnoticed, yet an important disease of chicken worldwide (Fadly, 1990). Outbreaks in susceptible avian species have been reported globally (Payne & Nair, 2012) and are known as one of the major causes of food insecurity and serious economic losses to poultry farming in terms of reduced production, uneven flock growth rates, reduced growth, immunosuppression which predisposes affected birds to bacterial and other diseases (Kheimar *et al.*, 2021). The causative agent of AL, avian leukosis virus (ALV), is an RNA virus belonging to the genus Alpharetrovirus of the family *Retroviridae*. Based on viral envelope glycoprotein, host range interactions between virus-specific cell receptors, and virus neutralization test, avian leukosis viruses (ALV) are classified into eleven subgroups; A, B, C, D, E, F, G, H, I, J, and K (Cheng *et al.*, 2010). Subgroups A-D, J and K are chicken oncogenic and exogenous viruses and usually horizontally transmitted, while subgroup E is ubiquitous, endogenous and non-pathogenic (vertically transmitted) ALV (Adkins *et al.*, 2001). The other four subgroups, which are F, G, H and I, are endogenous ALVs and occur mostly in partridges, quails and pheasants (Payne, 1998). ALVs are documented to be prevalent in several breeding flocks (Payne & Nair 2012). Globally, subgroups A, B and J are being considered as the most common ALVs affecting commercial poultry flocks (Gao *et al.*, 2014). Among the structural polypeptides (p27, p19, p15, p12 and p10) shared by all members of the Leukosis/Sarcoma (L/S) group of avian retroviruses including endogenous and exogenous ALVs, p27 is the most abundant and commonly detected antigen among commercial and exotic poultry (Owoede *et al.*, 2006; Sani *et al.*, 2012). In Nigeria, documented evidence reveals that neoplastic diseases are among the leading causes of death and economic devastation including production losses to the poultry industry (Kumbish *et al.*, 2015). However, there is a shortage of information as regards the status of this disease in local indigenous chicken in some parts of Kaduna metropolis and Nigeria at large. Therefore, this study will give an insight into the prevalence of the virus which will be useful in disease control to improve the health status and poultry production in the study area.

Materials and Methods

Study area

The study was carried out in Kaduna Metropolis, Nigeria that lies between latitude 9°30'0''N and 11°0'0''N and longitude 6°0'00''E and 9° 0'0'''E. The state shares boundaries with Katsina, Kano, and Zamfara States to the North, Plateau, Nasarawa State, and Federal Capital Territory to the South, Bauchi State to the East and Niger State to the West. The vegetation of the state is divided into northern Guinea savannah in the north and southern Guinea savannah in the south (Mohammed & Aliyu, 2014).

Blood collection and processing

In a cross-sectional study, 3-4 ml of blood sample were collected from 276 local chickens (LC) irrespective of age, at time of slaughter from 5 different LBMs in the study area: Kawo LBM (n = 56; Longitude 7º27'3.47 E, Latitude 10º34'35.45 N), Central LBM (n = 60; Longitude 7º25/34.55 E, Latitude 10º31/6.48 N), Railway station LBM (n = 50; Longitude 7º25/5.46 E, Latitude 10º29/40.93 N), Sabon Tasha LBM (n = 60; Longitude 7º31/42.35 E, Latitude 10º26/4.09 N), and Sokoto Road LBMs (n = 50; Longitude 7º26/2.42 E, Latitude 10º31/52.82 N). The collected blood samples were labelled, kept in a cool box and transported to the National Veterinary Research Institute (NVRI), Vom. In the laboratory, clotted blood samples were centrifuged at 3,000 rpm for 5 min to separate the clot from sera. Clear sera were collected into 0.2 ml sterilized Eppendorf tubes, properly labelled and kept at −20℃ until further analysis.

Enzyme-linked immunosorbent assay

The IDEXX ALV Antigen Enzyme Immunoassay (ELISA) was used for the detection of the antigen in the serum samples. The test is designed to detect p27, which is an antigen common to all subgroups of avian leukosis viruses including endogenous viruses. The samples were analyzed according to the manufacturer's instructions.

Data analysis

Descriptive statistics was carried out using a Microsoft Excels spreadsheet and proportions were obtained using open Epi. Version 2.3.1 Statistical tool (Open-Source Epidemiological Statistics for Public Health calculation). Pearson Chi-square ($\chi 2$) was conducted to assess the strength of association. P values less than 0.05 were considered significant.

Table 1: Seroprevalence of avian leukosis virus in local chicken in Kaduna State based on LBMs

Location	Total number of samples	Number positive	Prevalence (%)
Central market	60	18	30
Sabo tasha market	60	21	35
Kawo market	56	16	28.6
Sokoto Road market	50	7	14
Railway Road market	50	16	32
Total	276	78	28.3

χ^2= 6.8, df=4, p-value=0.147

Table 2: Seroprevalence of avian leucosis virus in local chicken in Kaduna state based on sex

Sex	Total number of samples	Number positive	Prevalence (%)
Male	171	46	26.9
Female	105	32	30.5
Total	276	78	28.3

Results and Discussion

In this study, overall seroprevalence of 28.3% (78/276) for ALVp27 antigen by ELISA was recorded. At market level, seroprevalences of 35% (21/60), 30(18/60), 32% (16/50), 28.6% (16/56) and 14% (7/50) were recorded for Sabon Tasha, Central market, Railway station, Kawo and Sokoto road LBMs respectively (Table 1). This contrasts with previous reports of Sani *et al.* (2012) and Miheso *et al.* (2017) who recorded a seroprevalence of 60% in Zaria, Nigeria and 58.33% in Kenya, respectively. These reports attributed the higher proportion of ALV in the local chicken as a result of free-range and management system which exposes the local chicken to infectious agents (Bebora *et al.*, 2005). Low seroprevalence in this study could probably be due to the age of the birds as blood samples were collected generally irrespective of the age and the birds sampled probably maybe younger ones which had less exposure time to this disease agent. Age is reported as a factor that contributed to higher seroprevalence of ALV among local chicken as longer exposure to the virus by older birds allows ample time for viral multiplication and establishment in the birds (Sani *et al.*, 2012). Another factor to the low seroprevalence may be attributed to the hardy nature of the local chickens in Nigeria which makes them resistant to many infectious diseases (Sani *et al.*, 2011). Seroprevalence of ALV concerning sex, female local chickens showed higher seroprevalence 30.5% (46/105) compared to male chickens 26.9% (46/171) with no statistically significant difference ($p > 0.05$). The variation may be due to immunological and physiological differences between the two sexes based on studies with other avian viral diseases, the vulnerable reproductive system of females compared to males and some immeasurable risk factors like behaviours can increase the risk of occurrence of viral diseases (Bettridge *et al.*, 2014). The differences may also be attributed to differences in the sample size collected as more females (n=171) were sampled than males (n=105). In conclusion, the detection of 28.3% (78/279) ALV seroprevalence in this study indicates natural exposure to ALV in the study area since the local chicken are not vaccinated against the disease and that may be transmitted naturally to other chickens as a result of contamination of the environment, therefore, threatening the economics of the poultry industry. We recommend surveillance and further studies on isolation, molecular characterization and pathogenicity of the virus.

Conflict of Interest

The authors declare that there is no conflict of interest.

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