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Full Length Research Paper

Seroprevalence of Newcastle Disease Virus Infection in Rural Household Birds in Lafia, Akwanga and Keffi Metropolis, Nasarawa State Nigeria

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A study was carried out to investigate the seroprevalence of Newcastle disease virus (NDV) in adult rural household scavenging birds raised under the traditional management system in Lafia, Akwanga and Keffi metropolis, Nasarawa State, Nigeria, through antibody detection using haemagglutination inhibition (HI) test. An overall seroprevalence rate of 28.1% was documented out of the 1030 sera tested. Chicken had seroprevalence rates of 58%, 51% and 55% in Lafia, Akwangwa and Keffi metropolis, respectively. These rates compared to those for guinea fowls and ducks in the entire metropolis were found to be significantly higher ($p<0.05$). NDV seroprevalence according to study location indicated 31.2% for Lafia, 28.8% for Akwanga and 24% for Keffi, which were not significantly different ($p>0.05$). HI antibody titres ranging between $4\log_2$ and $10\log_2$ were obtained. Chicken exhibited the highest antibody titre and had a significantly higher ($p<0.05$) geometric mean titre (GMT) 12.1 than guinea fowl (4.9) and ducks (4.9), respectively. These findings indicate that this category of apparently healthy birds are carriers of Newcastle disease virus and is a threat to commercial poultry production in the study area.

Key words: Newcastle disease, Seroprevalence, Rural Household Birds, Nasarawa State, Nigeria

INTRODUCTION

Newcastle disease (ND) is an acute, rapidly spreading, contagious, nervous and respiratory disease of birds of all ages caused by the avian Paramyxovirus serotype 1 (APMV-1) (Okeke and Lamorde, 1988). It is a major viral disease of economic importance in poultry (Anosa and Adene, 2007) and rated as one of the greatest constraints to the development of rural poultry production in Nigeria and in most developing countries, causing serious threats (Shamaki *et al*, 1989 and Oladele *et al*, 2003). The disease is caused by an enveloped, non- segmented RNA avian paramyxovirus 1 known as Newcastle disease virus which is transmitted through exposure to faecal, respiratory discharges or other discharges from infected birds and through contact with contaminated feeds, water, equipment, poultry attendants and clothing, leading to high morbidity and mortality (Oladele *et al*, 2003 and Saidu *et al*, 2006).

The disease is most common during harmattan period of the year (Alexander, 1997a) and occurs in domestic fowls, exotic birds, turkeys, ducks, geese, pigeons and wild birds (Roy and Chamham, 2007; Echeonwu *et at*,

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1993 and Echeonwu *et al*, 1997). It is characterized by nasal and ocular discharge, yellowish to greenish diarrhea, sneezing, coughing, drooping of wings, twisting of head, drop in egg production and thin shelled eggs, complete paralysis, weakness and sudden death (Chansiripomchai and Sasipreyayan, 2006; Roy and Chamham, 2007).

The poultry population in Nigeria is estimated at 104.3 million, comprising 72.4 million chickens, 11.8million ducks, 4.7million guinea fowls, 15.2 million pigeons and 0.2million turkeys (FDLPCS, 1992). The village poultry birds accounted for about 90% of the poultry population in Nigeria (Sonaiya, 1999) and, are kept by over 90% of rural households as local assets (Ndegwa *et al*, 2000). Besides, they provide an important source of high quality protein and are reserved for times of celebrities, as well as a good source of income for rural families (Abubakar *et al*, 2008). This category of birds represents a significant part of Nigerian rural economy in particular and of the national economy as a whole and are kept under the extensive management system in (Ajala *et al*, 1997). However, this group of birds is faced with all kinds of hardships, such as poor management, lack of external input for production and poor disease control. This has contributed to low productivity and high mortality rates (Ndegwa *et al*, 2000 and Njue *et al*, 2001).

Although analysis of poultry diseases has been conducted in some parts of Nigeria (Abdu *et al*, 1985; Salihu *et al,* 2010 and Saidu *et al*, 1994a), information on the prevalence of poultry diseases in rural poultry in Nasarawa State is rather scanty. This information is necessary for strategic planning for control of disease in poultry (Nawathe, 1988).

The aim of this study was therefore to determine the seroprevalence of NDV in scavenging unvaccinated indigenous household birds in the three metropolitan areas of Nasarawa State.

MATERIALS AND METHODS

Description of Study Area

Nasarawa State is located in North Central Nigeria and covers an area of 27,117 km^2 and population of 2, 040, 097 according to 2005 census. The state has 13 local government areas including Lafia, Akwanga and Keffi, which are the three metropolitan cities located in the southern, central and northern senatorial districts of the state, respectively. Akwanga covers an area of 996 Km^2 and population of 113, 430 according to 2006 census while Keffi covers an area of 138 Km^2 and population of 92, 664 according to 2006, whereas Lafia covers an area of 1115Km^2 and population of 330, 712. The state is bounded on the North by Kaduna, on the South by Benue, on the East by Plateau and Taraba States and on the West by Federal Capital Territory and Kogi States. Nasarawa State has a temperate climate which makes it a tourist attraction and favourable for agriculture and animal rearing.

Sample collection and processing

A total 1,030 unvaccinated adult local birds comprising of 444 chickens, 253 guinea fowls and 333 ducks were sampled from chicken markets and households in Lafia, Akwanga and Keffi metropolis between June and early October, 2011, representing the three geopolitical zones of Nasarawa State. About 3 mls of blood was collected from brachial vein of each bird into pre-labeled sterile bijou bottle, without anticoagulant. Blood samples were kept in slanted position, and serum samples were separated from clotted blood samples by centrifugation at 500 rpm for 15 minutes (Njigi *et al*, 2006). Sera were harvested by decanting into screw capped vials labeled according to species of bird and location of sampling. Serum samples were stored-frozen at – 20^0C until HI test was carried out.

NDV Antigen and Antisera

These were sourced from the stock of Virology Division, National Veterinary Research Institute (NVRI) Vom. The Newcastle disease virus Lasota strain as well as positive and negative NDV sera were reconstituted in equal volumes with phosphate buffered-saline (PBS p^H 7.2) prior to use to obtain neat suspensions.

Chicken Red Blood Cells

Chicken red blood cells (CRBC) were obtained from specific pathogen – free flock of the Poultry Department of NVRI, Vom. Blood was collected in acid citrate dextrose (ACD) anticoagulant and washed three times in PBS by centrifugation at 1000 rpm for 5min each time. Packed cell volume (PCV) was determined and a 10% suspension of the packed cell was prepared in PBS. This was stored at 4^0C in the refrigerator as stock CRBC suspension.

Standardization of the antigen

The NDV antigen was standardized by haemagglutination (HA) assay following standard procedures outlined by the

Table 1: Seroprevalence of NDV antibody among local poultry sampled in Lafia, Akwanga and Keffi metropolis, Nasarawa state

Study area	No of sera tested				Seroprevalent rates (%)			
	CH	GF	DK	**Total**	CH	GF	DK	**Total**
Lafia	170	92	110	372	99(58)	12(13)	5(5)	116 (31.2)
Akwanga	136	59	97	292	70(51)	7(12)	7(7)	84(28.8)
Keffi	138	102	126	366	76(55)	7(9)	4(3.2)	89(24)
Total	444	253	333	1030	245(23.8)	28(2.7)	16(1.6)	289(28.1)

CH chicken, **GF** guinea fowl, **DK** duck

Table 2: Distribution of NDV antibody among the species of birds sampled

Avian species	HI antibody titre ($\log_2$)									GMT
	2	3	4	5	6	7	8	9	10	
Chicken	97	56	30	18	20	9	11	1	3	12.1
Guinea fowls	23	3	1	1	-	-	-	-	-	4.9
Ducks	9	7	-	-	-	-	-	-	-	4.9

Office International des Epizootics OIE (2004). Following the assay, four haemagglutinating unit (4HAU) NDV antigen was determined and the suspension prepared in PBS for HI assay.

Haemagglutinatin inhibition test

The presence of NDV antibody was detected by haeagglutination inhibition (HI) assay as described by OIE (2004).

The validity of HI test was assessed against a negative control serum, which did not give a HI titer >$\log_2$2 and positive control for which the titre was within one dilution of the known titre (OIE, 2000)

Data Analysis

Data analysis was performed using Chi – square test for the variables of species of birds and study areas.

RESULTS

The overall seroprevalent rate of NDV antibodies was 28.1% (Table 1). Chicken had a significantly higher ($p<0.05$) seroprevalence in the three metropolis (Table 1), with a geometric mean titre (GMT) of 12.1 ($p<0.05$) compared to other species of birds sampled (Table 2). Seroprevalent rates according to study areas showed 31.2%, 28.8%, and 24% ($p>0.05$) for Lafia, Akwanga and Keffi, respectively. (Table 1). Newcastle disease virus (NDV) was found to be inhibited by NDV specific antibody in the test sera at titre ranging between 4 $\log_2$ and 10 $\log_2$ as demonstrated in haemagglutination inhibition (H1) test. The highest inhibition rate (10 $\log_2$) was exhibited by chicken sera (Table 1).

DISCUSSION

The present study revealed the occurrence of detectable Newcastle disease (ND) haemagglutinating (H1) antibodies in all the 3 species of local birds sampled in the three metropolis of Nasarawa State, which is indicative of activity of NDV infection in the areas. The findings of this study are similar to results of similar studies carried out in the neighbouring states of Plateau and Kaduna (Iroegbu and Echeonwu, 1997; Mai *et al*, 2004; Musa *et al*, 2009 and Nwanta *et al*, 2006). Other authors (Ezeokoli *et al*, 1985; Abdu *et al*, 1985; Nwanta, 2003; Saidu *et al*, 2006 and Olabode *et al*, 2006) have reported similar observations in other parts of Nigeria. The seroeroprevalence of NDV in these apparently healthy birds shows that they might have either survived clinical disease or subclinical infections and could thus act as reservoirs of the virus (Bell and Mouloudi, 1988; Olabode *et al*, 1992 and Orajaka *et al*, 1999).

Results of this study showed an overall ND virus seroprevalence of 28. 1%, with chicken having a

relatively higher rate ($p<0.05$) compared with guinea fowls and ducks. The higher prevalence in chicken may be attributed to a number of factors, which include: chickens are the most susceptible and most important host for Newcastle disease virus, high population of chickens compared to other domestic birds, which could contribute to spread of the virus in the environment.

It was also observed in the study that NDV HI antibodies were distributed in all the geographical areas under study. The distribution was however found to be statistically insignificant ($P>0.05$). The higher antibody occurrence rate in Lafia may be due to the higher concentration of commercial poultry in the area than Keffi and Akwanga. Vaccination activities of commercial poultry may contribute to mild infection due to spread of vaccine virus to local birds through commercial poultry workers, most of who hail from households where local birds are kept.

Newcastle disease HI antibody titre of between 4 $\log_2$ and 10 $\log_2$ and geometric mean titre 4.9 - 12.1 demonstrated among these apparently healthy birds, indicate that they have survived clinical or subclinical ND infection and produced neutralizing antibodies against the virus, hence presumed to be protected (Nwanta, 2003).

The village scavenging chickens constitute the bulk of the poultry population in Nigeria (Ibu, 2008). They outnumber the commercial chickens by a ratio of 8 to 1 making up to 70% the entire poultry population (Adene, 1990). These free range birds are often seen around some commercial poultry houses scavenging for food. It is also common to see commercial poultry workers keeping small number of free-range birds to which they first attend before resuming duties at the commercial farms. On the other hand, these free range birds are often in contact with wild birds with which they roam together at the vicinity of commercial poultry farms, thereby possibly acting as intermediaries between the wild birds and commercial Poultry in the transmission of ND. This therefore suggests the role of free range (local) birds in spread of ND in the environment.

Although ND viral isolation was not attempted in this study, detection of antibodies in this category of birds is suggestive of the presence and continuous circulation of NDV among them and their role in maintaining and spread of the ND. This could pose a serious threat to commercial poultry production Nigeria. It is hereby suggested that attempts be made to control NDV infection among village and scavenging birds through food-borne thermostable ND vaccine, which have been demonstrated to be efficacious and easy to administer by rural people (Echeonwu *et al* 2008; Echeonwu et al, 2007).

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Prevalence of Newcastle Disease virus antibodies in local and exotic

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