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# SERO-PREVALENCE OF NEWCASTLE DISEASE IN APPARENTLY HEALTHY NORMAL FEATHERED LOCAL CHICKENS IN IDO AND ATIBA LOCAL GOVERNMENT AREAS, OYO STATE, NIGERIA

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## ABSTRACT

***A study was conducted at Ido and Atiba Local Government Areas (LGAs) of Oyo State, Nigeria, to investigate the prevalence of Newcastle disease (ND) using Enzyme Linked Immunosorbent Assay (ELISA) techniques. A total of 376 normal feathered local chickens were sampled by collecting 2 ml of blood from each bird. Sera that emanated from them were subjected to detection of ND antibodies using ELISA test kit. The data collected were analyzed by inferential statistics. The results showed that the prevalence of ND as 11.70% and 15.43% at Ido and Atiba LGAs, respectively. Adult males showed higher prevalence as compared to adult females in the two LGAs. Meanwhile the prevalence of ND in adults was higher than in the young in Ido but the reverse at Atiba LGA. Combined prevalence was averaged at 13.56% in the two LGAs. The combined results further showed that males (8.24%) were more susceptible to ND than females (5.32%) just like adults (7.45%) were more susceptible than the growers (6.11%). It can be concluded that ND is prevalent in the study areas. It can therefore be recommended that vaccination of local chickens should be vigorously implemented since they are in the common environment/space with intensively managed birds to avert cross infection.***

**Key words:** antibodies, ELISA, local chickens, Newcastle disease, prevalence

## INTRODUCTION

Poultry production is the fastest growing component of global meat production in developing and transitional countries (Assa, 2012). Rojendran and Mohanty (2003) indicated that poultry farming has become foremost among the subsidiary occupations of farmers to supplement their incomes because it assures quick returns, requires minimum space and investment, and can be carried out by less skilled farmers. Poultry has been identified as a major source of national income that provides about 9-10% of nation's gross domestic product (GDP) worth $250 million (Anzaku *et al*., 2014). In Nigeria, poultry population is estimated to be 137.6 million, with backyard poultry population constituting 84% (115.8 million) and 16% (21.7 million) of exotic poultry, with a higher percentage of this poultry raised subsistently (FMARD, 2006). Indigenous village poultry production is an important economic activity for rural dwellers, and the poults are kept for meat and egg and sold to earn extra income (Abubakar *et al.*, 2008). Unfortunately, disease is a major hindrance to the realization of the full potential of village poultry due to high mortality it causes in Nigeria (Nwanta *et al.*, 2008). It was believed that the free range chickens act as potential reservoir of infection to themselves and the commercial birds (Emikpe *et al.*, 2003). Munir *et al.* (2012) stated that Newcastle disease (ND) has been reportedly consistent from all continents worldwide and is regarded as one of the most economically important diseases of chickens and other birds. The epizootics of Newcastle disease in poultry continue to occur in Asia, Africa, Central and South America while in Europe, sporadic epizootics occur (Nauem *et al*., 2013). The negative impact of the disease in both commercial and village poultry production systems is of great significance especially in Africa (Nwanta *et al.,* 2006). Annual economic losses in millions of dollars have been associated with ND outbreak (Susta *et al.,* 2011) and heavy mortality pattern in poultry (Waheed *et al.,* 2013). The sustainability of this subsector is being threatened as a result of incessant outbreaks of ND in unvaccinated flocks and sporadically in vaccinated flocks (Solomons *et al.,* 2012).

Newcastle disease is a highly contagious viral disease in domestic poultry, aviary and wild birds. Aldous and Alexander (2001) classified the ND strains into three pathotypes; highly virulent (velogenic), intermediate (mesogenic) and non-

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virulent (lentogenic). Although, an overlap of these strain classes exists in the field (Alexander, 2000). Severity of the disease often follows the virulence of the infecting strain amongst other factors such as host immune status, co-infections with other agents, age of host, environmental stress and endemicity (Okwor and Eze, 2013). According to variation in strains of ND-virus (NDV), the rate of mortality and morbidity in a flock varies from 90-100% along with decrease in egg production (Choi *et al.*, 2010; Haque *et al*., 2010). The clinical signs of ND are known to vary based on the virulence and tropism of the virus strain involved, species of the bird, age of the host, immune status, and environmental condition (Alders and Spradbrow, 2002). The disease is characterized by respiratory, nervous, gastrointestinal and reproductive impairments (Nanthakuwar *et al.,* 2000; Tiwari *et al.,* 2004).

Vaccines are conventionally used to control and prevent ND. Currently, many inactivated and live ND vaccines are available around the world (Shim *et al*., 2011; Xiao *et al.,* 2013). It is known that vaccination of poultry provides an excellent means to lessen clinical signs of infection caused by this virus (Alexander, 2003; Senne *et al*., 2004; Kapczynski and King, 2005). It has also been known for a long time that vaccination itself (with live vaccines based on non-virulent virus strains) may cause disease and reduced growth in vaccinated birds (Alexander, 2003). For confirmation of the ND, virus Hemagglutination and Hemagglutination Inhibition Test, virus Neutralization Test, Enzyme linked Immunosorbent Assay (ELISA), Plaque Neutralization Test and Reverse-Transcriptase Polymerase Chain Reaction (RT-PCR) can be used (Alexander and Allan, 1974). Therefore, this work was designed to investigate the prevalence of ND in the study areas with the aid of ELISA kit.

## MATERIALS AND METHODS

### Study Area

The study was carried out in the month of May 2018 at Ido (Bakatari, Eleso and Olosun) and Atiba (Elegbo, Oya-Tutu and Ikolaba) Local Government Areas (LGAs) in Oyo State, southwestern region of Nigeria. Ido LGA is located between longitude 3°33′20′′ and 3°51′11′′ E and latitude 7°17′50′′ and 7°44′50′′ N (Olatunji *et al*., 2016), whereas Atiba LGA lies within latitudes 3°49′31′′ and 3°59′34′′ N of the equator and longitude 8°34′44′′ and 8°35′38′′ E of the Greenwich Meridian (Gbiri *et al*., 2019). The average annual temperature and rainfall are 26.5 $^{o}$C and 1,311 mm$^{2}$ respectively whereas, Oyo city has latitude of 7° 51′ 9.25′′ N and longitude of 3° 55′ 52.50′′ E. Via a pre-field survey, the villages were purposively selected because of abundance of local chickens.

### Blood Sample Collection

One hundred and eighty-eight (188) blood samples were collected from birds in each Local Government Area using sterile syringes via brachial veins of the chickens. This summed up to three hundred and seventy-six samples (376). Both young and adult male and female chickens sampled were kept under semi-intensive system where they were allowed to roam and fend for themselves during the day and retire back to their pens for shelter and were sometimes given supplements in the evenings. Two milliliters (2 ml) of collected blood was deposited in a well labeled plain sample bottle. The bottles were kept in slanting positions for about 30 minutes for the blood to clot and the sera decanted into the Eppendorff tubes and put in ice pack for onward submission to the Avian Virology Laboratory, University of Ibadan, for preservation and laboratory analysis.

### Enzyme Linked Immunosorbent Assay Kit and Preparation

The ND ELISA test kit (Version 2016-01) was manufactured by Shenzhen Lvshiyuan Biotechnology Co., Ltd. China. The Greenspring$^{TM}$ Newcastle disease virus (NDV) antibody ELISA kit was developed to detect the NDV antibodies level in chicken serum sample and can be used to evaluate serological diagnosis of infected chickens, epidemiological surveys of Newcastle disease virus and analysis of Newcastle disease virus vaccine status in chickens. Manufacturer's guidelines were carried out to detect the NDV antibodies.

### Statistical Analysis

The results were subjected to descriptive statistics using Statistical Package for Social Sciences version17 program (SPSS Inc., Chicago, IL, USA). Prevalence for ND was calculated via the formular outlined by Bennette *et al*. (1991) and interpretation documented.

## RESULTS AND DISCUSSION

### Prevelance of ND at Ido and Atiba LGA

Table 1 shows the prevalence of Newcastle disease (ND) at various villages of Ido LGA comprising Bakatari, Eleso and Olosun villages. Out of 63, 63 and 62 birds screened in these villages, a total of 9 (14.29%), 5 (7.94%) and 8 (12.90%) were sero-positive for ND, respectively whereas at Atiba LGA (Table 2), with respect to Elegbo, Oya-Tutu and Ikolaba villages, out of 71, 60 and 57 birds screened at each, 13 (18.31%), 7 (11.67%) and 9 (15.79%) birds, respectively were sero-positive for the disease. At this LGA, out of the 188 birds screened, 29 (15.43%) showed positivity for the virus with an overall prevalence of 11.70%.

**Sero-Prevalence of ND by Age and Sex**

Table 2 shows the age/sex sero-prevalence of Newcastle disease at the study areas. The results further revealed that in Ido LGA, adult males (4.26%) had the highest prevalence of the virus followed by adult females (3.72%), grower males (2.13%) and the least was grower females (1.59%). This showed that males (6.39%) particularly adults were more susceptible to the virus than females (5.31%) whereas adults (7.98%) had more susceptibility than the growers (3.72%) according to the results. At Atiba LGA (Table 2), with respect to Elegbo, Oya-Tutu and Ikolaba villages, out of 71, 60 and 57 birds screened at each village, 13 (18.31%), 7 (11.67%) and 9 (15.79%) birds respectively were sero-positive for the disease. At this LGA, out of the 188 birds screened, 29 (15.43%) showed positivity for the virus. It can also be stated that males (10.11%) were more affected than females (5.32%) similar to Ido LGA, whereas the prevalence in the grower (8.51%) was higher than in adults (6.92%) as opposed to Ido LGA. Out of a total of 188 birds screened, 9 (4.79%) adult males, 10 (5.32%) grower males, 4 (2.13%) adult females and 6 (3.19%) grower females were positive for the disease.

Table 3 shows the combined prevalence of Newcastle disease in the study areas. From the 376 birds screened, 51 of them were sero-positive resulting to overall prevalence of 13.56%. It further showed that out of 84, 97, 97 and 98 chickens screened, adult males, grower males, adult females and grower females, 17 (4.52%), 14 (3.72%), 11 (2.93%) and 9 (2.39%) birds respectively showed positivity. This further affirmed that males (8.24%) were more susceptible to the disease than females (5.32%). With respect to age, adults (7.45%) were more susceptible than the growers (6.11%).

**Table 1:** Seroprevalence of Newcastle disease in the villages of Ido and Atiba LGAs, Nigeria

| Villages | Male A/G | Female A/G | Total | No. positive by age | | | | Total positive | Prevalence (%) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | AM | AF | GM | GF | | |
| Ido LGA | | | | | | | | | |
| Bakatari | 14/12 | 21/16 | 63 | 3 | 2 | 3 | 1 | 9 | 14.29 |
| Eleso | 14/11 | 22/16 | 63 | 2 | 2 | 1 | - | 5 | 7.94 |
| Olosun | 13/11 | 22/16 | 62 | 3 | 3 | - | 2 | 8 | 12.90 |
| Atiba LGA | | | | | | | | | |
| Elegbo | 18/13 | 20/20 | 71 | 4 | 4 | 2 | 3 | 13 | 18.31 |
| Oya-Tutu | 15 /10 | 20/15 | 60 | 2 | 3 | 1 | 2 | 7 | 11.67 |
| Ikolaba | 10/9 | 23/15 | 57 | 3 | 3 | 2 | 1 | 9 | 15.79 |
| Total | 84/66 | 128/98 | 376 | 17 | 17 | 9 | 9 | 51 | 13.56 |

Key: A/G - Adult/Grower, AM - Adult Male, AF - Adult Female, GM - Grower Male, GF - Grower Female

**Table 2:** Seroprevalence of Newcastle disease by age/sex in the villages of Ido and Atiba LGAs

| | No of birds | No positive | Prevalence (%) | | |
|---|---|---|---|---|---|
| | | | Total | Male | Female |
| Ido LGA | | | | | |
| Adult Male (AM) | 41 | 8 | 4.26 | 4.26 | - |
| Grower Male (GM) | 34 | 4 | 2.13 | 2.13 | - |
| Adult Female (AF) | 65 | 7 | 3.72 | - | 3.72 |
| Grower Female (GF) | 48 | 3 | 1.59 | - | 1.59 |
| Total | 188 | 22 | 11.70 | 6.38 | 5.32 |
| Atiba LGA | | | | | |
| Adult male (AM) | 43 | 9 | 4.79 | 4.79 | - |
| Grower Male (GM) | 63 | 10 | 5.32 | 5.32 | - |
| Adult Female (AF) | 32 | 4 | 2.13 | - | 2.13 |
| Grower Female (GF) | 50 | 6 | 3.19 | - | 3.19 |
| Total | 188 | 29 | 15.43 | 10.11 | 5.32 |

**Table 3:** Combined seroprevalence of Newcastle disease at the study areas

| | No. of birds | No. positive | Prevalence (%) | | | | |
|---|---|---|---|---|---|---|---|
| | | | Total | Male | Female | Adult | Grower |
| Adult Male | 84 | 17 | 4.52 | 4.52 | - | 4.52 | - |
| Grower Male | 97 | 14 | 3.72 | 3.72 | - | - | 3.72 |
| Adult Female | 97 | 11 | 2.93 | - | 2.93 | 2.93 | - |
| Grower Female | 98 | 9 | 2.39 | - | 2.39 | - | 2.39 |
| Total | 376 | 51 | 13.56 | 8.24 | 5.32 | 7.45 | 6.11 |

## DISCUSSION

Newcastle disease is considered an endemic disease among backyard and commercial poultry in Nigeria. Despite vigorous vaccination trials and campaigns, there were still reports of frequent outbreaks of the disease in the country among village and commercial poultry population (Okwor and Eze, 2013; Mai *et al*., 2014). However, sero-prevalence survey still remains an important step towards immediate detection and effective control of the disease. The implication of the spread and the carrier status of the rural household chickens could be of importance considering the fact that rural chickens were reported to constitute over 90% of chicken population in Nigeria and are capable of scavenging around the environment, spreading the NDV to vaccinated and unvaccinated healthy exotic birds (Musa *et al*., 2009). Several outbreaks of virulent strains have been reported throughout the world, and these strains are endemic in many countries including Asia and Africa (Miller *et al*., 2010).

The sero-prevalence rates obtained in this work were higher than those of Chukwudi *et al*. (2012) who reported a prevalence of 3.2% for NDV in clinically healthy chickens in Nsukka area, Enugu State but were similar to the results of 17.0% obtained by Abraham-Oyiguh *et al*. (2014) and 20.8% in local chickens by Daodu *et al*. (2019) at various LGAs in Kwara State, as well as 14.1% previously reported by Olabode (2012) in Kwara State but differed from 32.2% reported in Kaduna by Nwanta *et al.* (2008), in Nigeria. The difference in prevalence could be adduced to the fact that Chukwudi *et al*. (2012) worked on exotic birds that were probably vaccinated against ND. Other studies conducted on village chickens at live bird markets in Nigeria by Ameji *et al*. (2011), Chollom *et al*. (2013), Jibril *et al*. (2014) and Eze and Ike (2015) showed 96, 35.8, 25.5 and 65.1% sero-prevalence rates, respectively. These observed differences in ND sero-prevalence showed ecological area variation in NDV activity and may perhaps be a reflection of the impact of environment on the viability and spread of NDV and its epidemiology (Eze and Ike, 2015). It has also been reported that most village chickens in Nigeria are seldom routinely vaccinated against ND using the conventional vaccines (Okwor and Eze, 2011). Therefore, detection of antibodies to ND in apparently healthy chickens might be indicative of natural infection by non-virulent or lentogenic strains of the virus that might not cause clinical diseases but acts like vaccine. However, at the period of sampling, some birds might be incubating the disease in a subclinical state (Chukwudi *et al*., 2012; Ibitoye *et al*., 2013; Mai *et al*., 2014; Eze and Ike, 2015).

The results from this study which were obtained in the Month of May were lower than the prevalence of 80.9% reported by Ibitoye *et al.* (2013) in Sokoto State, Nigeria, 81.8% by Boakye *et al*. (2016) in Kumasi, Ghana, 55.5% and 53.7% by Lawal *et al*. (2015) and Lawal *et al*. (2016) in a ten-year retrospective study of ND cases reported and diagnosed in Veterinary clinics in Gombe metropolis, Nigeria. The difference might be as a result of seasonality of Newcastle disease virus having high occurrence in the months of March and October which coincides with the onset of rainy and dry seasons respectively. In addition, the seasonality factor such as harmattan period when there is extreme cold, wind and stress might also contribute to the wide margins in the earlier works. High wind movement could transfer infection from one poultry house or flock to the other (Manchang *et al*., 2004; Musa *et al*., 2009). In contradictions too, Hadipour (2009) examined 350 blood samples of backyard chickens for NDV antibodies and 37.56% of samples were positive, and mean HI titre was 5.21. In another study on village chickens in Iraq, 46% and 34.4% were seropositive by ELISA and HI tests, respectively (Aziz and Ahmed, 2010). Kite *et al.* (2007) reported that 300 (39.84%) out of 753 surveyed farms throughout Australia were positive for NDV infection. In another report from Bangladesh, 78.04% samples of broilers and 96.67% of layers were positive for NDV antibodies (Mozaffor, 2010) whereas Ghaniei and Mohammadzadeh (2012) reported 40.6% ND seroprevalence in Iran out of 383 blood samples collected from two slaughter-houses in West Azarbayjan and subjected to HI test. Lawal *et al.* (2016) reported 62.7% ND seropositivity for local chickens and out of 320 guinea fowls and 39 pigeons sero-tested, 98 (30.6%) and 19 (48.7%) were seropositive for ND antibodies respectively at Gombe State, Nigeria. Therefore, detection of ND antibodies in this study could be an indication of natural infection since the poultry species sampled were adults and growers. The presence of maternal antibodies can be ruled out, because maternal antibodies disappear after the age of 3-4 weeks (El-Yuguda *et al*., 2009).

**Prevalence by Age and Sex Classification**

The result obtained from this study showed that Adults (7.45%) had higher prevalence when compared to the growers (6.11%). This result was not in agreement with Manchang *et al.* (2004) who reported a higher prevalence in the Young/grower (20.7%) against 12.1% in the Adults. The higher prevalence in the adults might be as a result of waned innate or non-specific immunity. The implication of the spread and the carrier status of the domestic birds could be of importance considering the fact that rural chickens were reported to constitute over 90% of chicken population in Nigeria and are capable of scavenging around the common environment spreading NDV to vaccinated and unvaccinated exotic birds (Musa *et al.,* 2009). With regard to sex,

the results obtained in this study is in tandem with the study of Jibril *et al*. (2014) who found higher overall prevalence of ND in male chickens than in females in Nigeria as well as that of Boakye *et al*. (2016) in Ejisu-Besease (83.3%) and Ejisu-Adumasa (98.4%) for females whereas the males had 100% sero-positivity in Kumasi, Ghana. In contrast, Awuni (2002) reported significantly higher ND in females (hens) than males (cocks).

## CONCLUSION

From this study, it can be concluded that the overall sero-prevalence of 13.56% for ND was quite moderate compared to most results obtained elsewhere by other authors. Males have also shown to be more affected than females. More so, adults showed more susceptibility to ND than grower indigenous birds.

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