

Research Article

Serological Survey of Newcastle Disease in Free Ranging Local Chickens in the Federal Capital Territory, Abuja, Nigeria

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A serological survey was carried out in four area councils (Abuja Municipal, Kuje, Gwagwalada, and Kwali) of the Federal Capital Territory (Abuja) to determine the prevalence of antibodies to Newcastle disease virus in local chickens using haemagglutination inhibition (HI) tests. In each area council, one hundred sera samples were collected from apparently healthy local chickens with no history of vaccination. Abuja Municipal, Kuje, Gwagwalada, and Kwali area councils had prevalence of 37, 44, 79, and 68%, respectively. The overall prevalence of antibody to Newcastle disease in the four area councils was 57%. This study shows that Newcastle disease virus is circulating in local chickens in the study area, and this may pose a serious threat to the commercial poultry industry within these four area councils of the Federal Capital Territory (Abuja) where this study was carried out.

1. Introduction

Newcastle disease is a viral disease of birds caused by Newcastle disease virus (NDV) [1]; it belongs to paramyxovirus type I (APMV-I) serotype of the genus *Avulavirus* belonging to the subfamily Paramyxovirinae and family Paramyxoviridae, and it is a single-stranded RNA virus. Newcastle disease (ND) occurs worldwide and is regarded as one of the most economically important diseases of chickens and other birds; the first reported outbreak of ND in Nigeria was in and around Ibadan [2]. The disease is transmitted through direct contact of the healthy birds with faeces and other body fluids from infected birds and also through contact with contaminated feed, water, equipment, and clothing [3]. Virulent strains of NDV may cause high mortality rate of almost 100 percent with or without clinical signs especially in unvaccinated birds. ND has been reported in vaccinated birds, which may be due to vaccine failure [4]. Although NDV can be destroyed by heat, ultraviolet rays of the sun, and some disinfectants, it can

survive for several weeks in a warm and humid environment, on birds' feathers, manure, and other materials, and in frozen materials [1]. In Nigeria and other developing countries, poultry is one of the major sources of animal protein to man, and it provides quick returns on investment compared to livestock, and this led to increased attention to poultry health by farmers [5, 6]. Studies carried out in rural chickens in Nigeria by Ezeokoli et al. [7] showed 73% prevalence of antibodies to NDV in traditionally managed backyard flocks in Zaria; 63% seroprevalence was reported by Orajaka et al. [8] in southeastern Nigeria; 38% seroprevalence was reported by Oyewola et al. [9] in southwestern Nigeria around Ibadan; and Musa et al. [10] reported prevalence of 51.9% in Plateau State. Vaccination has been reported as the only safeguard against endemic ND [8]. In order to formulate appropriate vaccination schedule and control measures, the serological status of NDV among chickens in the study area needs to be elucidated due to the high demand for poultry and poultry products in Nigeria.

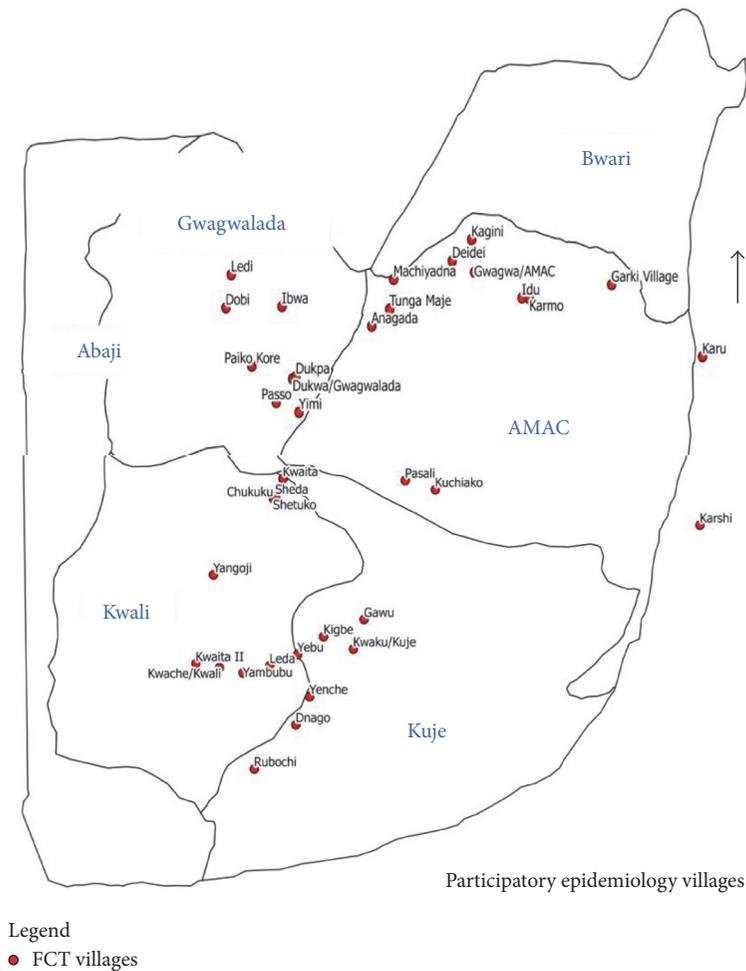


FIGURE 1: Map of the Federal Capital Territory (Abuja) showing area councils (QGIS 1.6 Software).

2. Methodology

2.1. Study Area. The Federal Capital Territory (Abuja) is the capital city of Nigeria and is made up of six area councils (Bwari, Gwagwalada, Abaji, Area Municipal Council (AMAC), Kwali, and Kuje [11]) (Figure 1). The Federal Capital Territory (Abuja) was created in 1976 and is bordered to the west and north by Niger State and to the northeast by Kaduna State, with Nasarawa State in the east and southeast and Kogi State to the southwest. It lies between latitude $8^{\circ}25'$ and $9^{\circ}20'N$ and longitude $6^{\circ}45'$ and $7^{\circ}39'E$. It has an approximate land mass of $7,315\text{ km}^2$ and is situated on the Northern Guinea Savannah Zone with moderate climatic conditions with a population of 1,405,201 people (according to [11]). According to the records of the Nigerian poultry population, there are a total of 3,812,288 poultry in FCT out of which 84% (3,465,000) are local chickens and 16% (347,288) are exotic chickens [12]. Out of the six area councils of Abuja, four area councils were selected for this study.

2.2. Study Design. This study is a cross-sectional type and was carried out in 40 villages of four area councils (Abuja

Municipal, Kuje, Gwagwalada, and Kwali) of the FCT. These villages were purposively selected due to the presence of poultry and livestock population and their market.

2.3. Study Population. The study population consisted mostly of free ranging (extensively managed) family poultry that have the possibility of mixing with other birds and animals. Each village was considered as one epidemiological unit assuming that the chickens in each village were kept as free ranging and had the possibility of mixing with other poultry species and livestock.

3. Sample Collection

Samples were collected from 400 apparently healthy unvaccinated local chickens in the four selected area councils of the FCT. About five milliliters (5 mL) of blood was collected from each of the birds using 10 mL syringe and was placed at an angle of 45° for about 20 to 30 minutes, after which the serum was then decanted into sample bottle, and it was stored at -4°C in a freezer. The sera samples were transported in a cold chain to the Viral Zoonoses Laboratory of the Department of

TABLE 1: Table showing average ND titre values in the four area councils of the Federal Capital Territory, Nigeria.

Area council positive	Number of samples tested	Number of samples tested negative (percentage -ve)	Number of samples tested positive (percentage +ve)
Abuja Municipal	100	63 (63%)	37 (37%)
Kuje	100	56 (56%)	44 (44%)
Gwagwalada	100	21 (21%)	79 (79%)
Kwali	100	32 (32%)	68 (68%)
Total	400	172 (43%)	228 (57%)

Key. -ve: negative; +ve: positive; %: percentage.

Note. From the table above, figures of number not in parentheses are numbers of sera samples positive or negative, while those in parentheses are percentage positive or negative of the sera samples.

The overall prevalence of antibodies to Newcastle disease in the four area councils of FCT was 57%, while the prevalence of antibodies to Newcastle disease in each area council is as follows: Abuja Municipal, Kuje, Gwagwalada, and Kwali area councils had prevalence of 37, 44, 79, and 68%, respectively.

Veterinary Public Health and Preventive Medicine, Faculty of Veterinary Medicine, ABU, Zaria, for haemagglutination inhibition tests to detect antibodies to ND virus.

4. Haemagglutination Inhibition Test

Sera collected from rural chickens were tested for NDV specific antibody by the haemagglutination inhibition (HI) test as described by Allan and Gough [13] and Hossain et al. [14]. This test was carried out according to the procedure of OIE [15], and the procedure of OIE for HI is as follows: the HI test was performed using beta technique (constant virus and varying serum) against 4 haemagglutinating (HA) units of the virus computed from the HI titration. Phosphate buffer saline (PBS) in V-bottomed microtitre plates up to the 10th well was used for twofold serial dilution of 25 μ L serum. Twenty-five microlitres of 4 haemagglutinating (HA) units of NDV virus or antigen (Lasota) was added up to the 11th well. The plates were kept at room temperature for more than 30 minutes to enhance antigen-antibody reaction. After that, 50 μ L of 1% (v/v) chicken RBC suspension was added to each well. The 11th well contains antigen and RBCs as the positive control and the 12th well contains only RBCs as the negative control. The RBCs were gently mixed and allowed to settle at room temperature for 40 minutes and agglutination was assessed by tilting the plates. The samples showing peculiar central button shaped settling of RBCs were recorded as positive and maximum dilution of each sample causing haemagglutination inhibition was considered as the end point which was used to estimate the HI titre. The HI titre of each serum sample was expressed as reciprocal of the serum dilution and most conveniently expressed as the logarithm to the base 2. The HI test is based on the principle that the haemagglutinin on the viral envelope can bring about the agglutination of chicken red blood cells and that this can be inhibited by specific antibodies. In the absence of any antibody against the virus, haemagglutination occurs, appearing as a diffuse red colour at the bottom of the well. In the wells where the antibody against the virus is of a sufficient level, haemagglutination is inhibited and the red blood cells sediment and appear as a small pellet at the bottom of the well [15]. The presence or absence of agglutination is accurately assessed by tilting

the plates. Only those wells in which the RBCs stream at the same rate as the control wells (containing RBCs and PBS only) should be considered to show inhibition [15].

5. Statistical Analysis

The mean titre values obtained from the HI test were subjected to descriptive statistics to determine the frequency and distribution of NDV antibody titre in the four area councils (Table 1). Titre values obtained were entered into SPSS (16.0) and subjected to descriptive statistic.

6. Results and Discussion

Out of 400 sera samples collected from four area councils of FCT (Abuja Municipal, Kuje, Gwagwalada, and Kwali), 228 were positive for antibodies to Newcastle disease and this shows that 57% of the total sera samples collected from the four area councils were positive for antibodies to Newcastle disease, while 172 of the sera samples were negative for antibodies to Newcastle disease; that is, 43% of the total sera samples collected from the four area councils were negative for antibodies to Newcastle disease. In each of the area councils, one hundred sera samples (100) were collected, and the results are as follows. In Abuja Municipal area council, 37 of the sera samples were positive for antibodies to Newcastle disease, which represent 37% of the total sera samples collected from Abuja Municipal area council, while 63 of the sera samples were negative for antibodies to Newcastle disease, which represent 63% of the total sera samples collected from the Abuja Municipal area council. In Kuje area council, 44 of the sera samples were positive for antibodies to Newcastle disease which represent 44% of the total sera samples collected from the Kuje area council, while 56 were negative for antibodies to Newcastle disease which also represent 56% of the total sera samples collected from Kuje area council. In Gwagwalada area council, 79 of the sera samples were positive for antibodies to Newcastle disease, which represent 79% of the total sera samples collected from Gwagwalada area council, while 21 of the sera samples were negative for antibodies to Newcastle disease which also represent 21% of the total sera samples collected from Gwagwalada

area council. And in Kwali area council, 68 of the sera samples were positive for antibodies to Newcastle disease which represent 68% of the total sera samples collected from Kwali area council, while 32 of the sera samples were negative for antibodies to Newcastle disease which also represent 32% of the total sera samples collected from Kwali area council. From the above result, it is shown that the virus is circulating more in Gwagwalada area council compared to the other three area councils followed by Kwali and then Kuje, while Abuja Municipal area council had the least. The prevalence (57%) of antibodies to Newcastle disease recorded in the four area councils may be attributed to the role that road networks play in the spread of disease in poultry in Nigeria [16]. Those samples whose antibody titre was less than 1:16 (<1:16) are considered as negative sera samples, while those sera samples whose antibodies titre was greater than 1:16 ($\geq 1:16$) are considered as positive sera samples.

Detection of antibodies to Newcastle disease in unvaccinated local chickens in the four area councils showed that the birds were exposed to the virus either through ingestion of feed or water or through inhalation of the virus, and this may be through contact with infected birds or infected materials such cloths, utensils, and boots. Those chickens testing positive to Newcastle disease may be those that survive the outbreak in the study area or those that were purchased from other areas that had the outbreak before the study area since vaccination of the village poultry is rarely undertaken in Nigeria or those that are incubating the disease [8, 17–20]. The seroprevalence rates (percentage positive) ranging from 37% to 79% in this study are in line with the findings of many researchers in Africa and elsewhere. In similar studies, Yongolo [21] reported variable seroprevalence of 25–81.5% in Tanzania; in Ethiopia, 43.68% seropositive rate of NDV was reported in the cool central highlands [22], while Zeleke et al. [23] reported 19.78% and Courtecuisse et al. [24] reported 14% seroprevalence in nonvaccinated village chickens in Niger. Hadipour [25] reported prevalence of 37.56% in backyard chickens in Iran. Ezeokoli et al. [7] reported 72% seroprevalence of antibodies to NDV in traditionally managed, nonvaccinated village chickens in Nigeria. El-Yuguda et al. [26] reported prevalence of 46% in village chickens in Borno State. Salihu et al. [27] reported ND prevalence of 54.67% in neighbouring Nasarawa State. The findings of other similar studies carried out in Nigeria include Iroegbu and Echeonwu [28], Mai et al. [29], Musa et al. [10], Nwanta et al. [30], Ezeokoli et al. [31], Abdu et al. [32], Nwanta [33], Saidu et al. [34], and Olabode et al. [3].

The presence of antibodies to Newcastle disease (ND) shows that the Newcastle disease virus is circulating in the study area and it may serve as a threat to the poultry industry. With the extensive system of rearing local chickens in these study areas, once an outbreak of Newcastle disease occurs, it is possible to experience high morbidity and mortality rate which may eventually affect the food security, especially protein of animal origin, and this may result in malnutrition among the general populace; apart from the food security, it may result in a high rate of unemployment in the country, since poultry rearing is a fast growing industry in Nigeria; in the absence of this poultry industry in Nigeria, there

may be a lot of criminal activities such as stealing, armed robbery, and kidnapping. Establishing commercial poultry farms (stocking with exotic breeds of birds) in these areas may be a huge loss to the farmer if he or she did not vaccinate his or her birds against Newcastle disease. It is therefore advisable to vaccinate all birds in the study area yearly to prevent an outbreak of Newcastle disease.

7. Conclusion

Antibodies to Newcastle disease were detected in unvaccinated local chicken in four area councils of the FCT (Abuja), Nigeria, with the highest prevalence rate at Gwagwalada area council compared to the other three area councils.

Competing Interests

The authors declare that they have no competing interests.

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