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308 Lasani Town, Sargodha Road, Faisalabad - Pakistan  
Mob: +92 300 3008585, Fax: +92 41 8815544  
E-mail: editorijps@gmail.com

## Seroprevalence, Seasonal Occurrence and Clinical Manifestation of Newcastle Disease in Rural Household Chickens in Plateau State, Nigeria

U. Musa<sup>1</sup>, P.A. Abdu<sup>2</sup>, I.I. Dafwang<sup>2</sup>, J.U. Umoh<sup>2</sup>, L. Sa'idu<sup>2</sup>, U.M. Mera<sup>3</sup> and J.A. Edache<sup>1</sup>

<sup>1</sup>National Veterinary Research Institute, Vom

<sup>2</sup>Faculty of Veterinary Medicine and NAERLS, Ahmadu Bello University, Zaria, Nigeria

<sup>3</sup>Faculty of Veterinary Medicine, Usman Danfodio University, Sokoto

**Abstract:** A study on seroprevalence, seasonal occurrence and clinical manifestation of Newcastle Disease Virus (ND) among rural household chickens and Live Birds Markets (LBM) was conducted using haemagglutination Inhibition Test (HI) and questionnaires. A total of 1, 208 chickens reared under extensive management system in four Local Government Areas (LGAs) of Plateau State were used for the study. The seroprevalence of ND virus antibodies in rural chickens showed that there was no statistically significant ( $p \geq 0.05$ ) difference among the four LGAs and of the 1,208 sera tested, 51.9% had detectable antibodies to NDV but only 14.1% of the chickens had HI antibody titre of  $\geq 4\log_2$  which was considered as protective. About 86.2% of the chickens sampled were at risk of suffering from clinical ND. Newcastle disease outbreaks occurred year round in the villages sampled with the highest incidence of 86.6% observed from November to March (Dry season) and September to October, 8.31% (Pre-dry season). During outbreaks of ND, infected birds exhibit the following major clinical signs; nervous signs (32.4%), weakness (16.6%), whitish/greenish diarrhea (16.2%), coughing/sneezing 13.6%, anorexia 9.39% and others 11.8%. It was concluded that the prevalence of ND in the four LGAs of Plateau State is high. At the time of the study over 80% of rural chickens in Plateau State were at risk of dying from ND when exposed to a virulent NDV. It is therefore recommended that vaccination and improved management practices as a means of prevention against ND before the period of outbreaks should be instituted.

**Key words:** Antibodies, Newcastle disease, live birds markets, rural chickens

### INTRODUCTION

Serological studies in rural chickens were made in several countries. In the Khon Kaen province in Thailand, a health and productivity study in native rural chickens was carried out in two villages from September 1987 to August 1988 (Thitisak *et al.*, 1988). The mean HI titre for ND was high in newly hatched chicks, and declined as maternal antibodies disappeared at about 90 days. Thereafter, mean titres rose steadily as the age of birds increased, peaking in birds three years of age. However, the proportion of seropositive samples was not stated. In Morocco, rural chicken flocks in six different regions were studied for the prevalence of ND (Bell and Mouloudi, 1988). Serum samples were obtained from 100 unvaccinated chickens from different regions. Antibodies against NDV were found in each region ranging from 5 -83% (average 35%) of the chickens sampled.

In Tanzania, 13.3% of the chickens were seropositive when HI test was performed prior to vaccination against ND from 120 chickens > 4 months from five villages (Minga *et al.*, 1989). In Mauritania, serum samples were obtained from 80 chickens in rural poultry flocks in each of three different regions. Antibodies against NDV were detected in 4.6% of chickens. A serological study was also conducted in Benin in three ecologically different

regions in the south, centre and north. Seropositivity of chickens for NDV was 56, 75 and 69%, respectively (Bell, 1992).

In Nigeria, a study carried out in rural chickens by Ezeokoli *et al.* (1984), showed a 73% prevalence of antibodies against NDV in traditionally managed backyard flocks in Zaria, while 63% seroprevalence was reported by Orajaka *et al.* (1999) in south eastern Nigeria. In south western Nigeria around Ibadan, 38% seroprevalence was reported by Oyewola *et al.* (1996). These observed regional differences in ND seroprevalence showed ecological area variations in NDV activity and may perhaps be a reflection of the impact of environment on the viability of NDV, spread and its epidemiology (Orajaka *et al.*, 1999).

Though, the presence of specific antibodies to NDV in the serum of birds gives little information on the infecting strain of the virus and therefore has limited diagnostic value in relation to NDV strain. However, the demonstration of the presence of infection and seasonal occurrence may be sufficient for the needs of a diagnostician for planning control measures. The clinical manifestation may give an indication on the type of the virus circulating in the study area. Therefore, the objective of this study was to determine the seroprevalence, season of occurrence of ND in rural

chickens in Plateau state and to determine the population at risk for possible preventive measures.

## MATERIALS AND METHODS

**Sampling:** A multi stage sampling procedure was adopted to select four LGAs and eight villages per local government area for the study. The LGAs were Jos South, Barkin Ladi, Kanam and Shendam LGAs. Random sampling procedure was used to select the eight villages from each LGA. The study was conducted from January 2006 to June 2007. Thirty two villages with 1, 240 households were selected and visited.

**Blood collection:** Two milliliters of blood were collected through the jugular or wing vein using sterile 2 mL syringe and 21 G needle. Blood samples were collected from chickens of different ages that had no history of previous vaccination against ND. Sera were separated by allowing the blood samples in the test tubes to slanted in racks at room temperature for one to two hours to clot. The sera were then decanted leaving the blood clot. The decant sera were transported immediately to the laboratory and stored in cryovials at -20°C freezer until tested.

**Serology:** Sera were tested for NDV specific antibody by the haemagglutination inhibition test (HA) by the method described by Allan and Gough (1974) using micro method. Newcastle disease La Sota virus was used as antigen. Sera with HI antibody of  $\geq 4 \log_2$  were considered positive based on OIE recommendation of 2000.

**Data collection:** A total of 1,240 structured questionnaires were administered to rural poultry farmers and where necessary interviewed. Interpreters were sought where necessary. Numerical aspects of the information were collated and analyzed.

**Data analysis:** Geometric mean of HI antibody titre (GMT) and percentages of detectable NDV HI antibody titre were calculated. The Statistical Package for Social Sciences (SPSS) Programme (version 13) was used to compare if there was any significant difference between the geometric means of the HI antibody titre.

## RESULTS

The seroprevalence study shows that 51.9% of the rural chickens sampled had detectable antibodies to NDV which indicated evidence of ND virus infection (Table 1). The LGA with least the number of chickens with detectable antibodies was Kanam, while Jos South had the highest (93.6%) number of chickens at risk (Table 1). Out of the 1,208 sera analyzed 170, (14.1%) had NDV HI antibody titre of  $\geq 4 \log_2$ . The overall percentage of rural chickens at risk in the LGAs sampled was high (86.0%).

Newcastle disease outbreaks occurred year round in the villages sampled (Table 2). However the highest incidence (86.6%) of ND was observed from November to March (Dry season) and September to October 8.0% (Pre-dry season). During outbreaks of ND, infected birds exhibit the following major clinical signs; nervous signs (32.0%), weakness (16.6%), whitish/greenish diarrhea (16.2%), coughing/sneezing (13.61%), anorexia (9.39%) and other signs (11.8%) (Table 3).

## DISCUSSION

The present study showed a relatively higher (51.9%) seroprevalence rate of ND virus antibodies in rural chickens in the four LGAs, compared to what has been reported (41%) earlier by Adu *et al.* (1986). Although there was no significant differences ( $p>0.05$ ) between ND seroprevalence rate in the different LGAs, the observed differences in the rates of NDV HI antibodies in the four LGAs may be as a result of ecological variations in ND activity or sampling methods and may perhaps be a reflection of the impact of environment on the viability of NDV and epidemiology (Orajaka *et al.*, 1999). Other factors responsible for differences in NDV HI antibody may be as result of concentration of commercial poultry in the LGAs sampled. About 80% of the commercial poultry were located in Jos South and Barkin Ladi LGAs. Commercial poultry are routinely vaccinated against ND virus but rural household chicken may come in contact with them especially during sales or processing.

The observation that birds in Plateau State had NDV antibodies indicates that ND is wide spread in the areas studied. 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 (Sa'idu *et al.*, 2006). Newcastle disease occurs year round in most rural poultry populations, but is most common and severe at times of climatic stress. Outbreaks are often associated with change of season, Cold and hot weather have been cited as contributory factors in ND outbreaks (Abdu *et al.*, 1992). The disease was also reported to be more common during the dry harmattan (November-March) and cold stress has been known to worsen the outcome of ND (Halle *et al.*, 1999; Sa'idu *et al.*, 2006).

None of the chickens sampled had a history of previous vaccination against ND. It is therefore deduced that antibodies detected in the rural chickens in this study were as a result of natural infection by NDV. Therefore, the 51% seroprevalence rate of ND antibodies in the four LGAs could be attributed to factors such as the management system in traditional production which may

Table 1: Distribution of Newcastle disease virus antibodies in rural household chickens and live bird markets in four Local Government areas of Plateau State

LGA	No. of sera tested	No. of detectable antibody titre		Mean $\pm$ SD log <sub>2</sub>	No. of sera positive for ND antibodies		No. of rural chickens at risk of ND	
		F	%		F	%	F	%
Shendam	230	114	49.6	1.4 $\pm$ 2.0	32	139	198	86.1
Kanam	226	97	42.9	1.1 $\pm$ 1.8	24	10.6	202	89.4
Jos South	283	165	58.0	0.6 $\pm$ 1.6	18	6.4	265	93.6
Barkin Ladi	223	121	54.3	1.3 $\pm$ 1.7	22	10.0	204	91.5
Jos South (Market)	198	103	52.0	2.2 $\pm$ 3.3	58	29.3	140	70.7
Shendam (Market)	48	27	56.3	2.5 $\pm$ 3.7	16	33.3	32	66.7
Total	1, 208	627	51.9		170	14.1	1,041	86.2

Antibody titres of  $\geq 4 \log_2$ , were considered positive to ND based on OIE recommendation of 2000. F = frequency, % = percentage, SD = Standard deviation.

Table 2: Season of Newcastle disease outbreaks in rural chickens of Plateau State

Season		Jos South	Local Government Area			Total
			Barkin Ladi	Kanam	Shendam	
November to March (dry season)	F	103	192	199	198	692
	%	13.0	24.0	25.0	24.6	86.6
April to May (pre rainy season)	F	17	14	3	0	34
	%	2.0	1.74	0.4	0	4.0
June to August (rainy season)	F	1	5	6	1	13
	%	0.12	0.62	0.74	0.12	1.60
September to October (pre dry season)	F	46	2	16	3	67
	%	5.71	0.25	1.99	0.37	8.00
Total	F	167	213	224	202	806
	%	20.72	26.43	27.79	25.06	100.0

F = frequency, % = percentage.

Table 3: Major clinical signs observed by farmers in sick rural chickens suspected of suffering from Newcastle disease

Season		Jos South	Local Government Area			Total
			Barkin Ladi	Kanam	Shendam	
Nervous signs (Abnormal)	F	15	45	32	146	238
	%	2.0	6.0	4.0	20.0	32.0
Not active	F	78	73	33	6	190
	%	10.6	10.0	4.5	1.0	26.10
Whitish/greenish diarrhea	F	14	60	27	18	119
	%	2.0	8.0	3.7	2.5	16.2
Coughing/sneezing	F	3	2	79	16	100
	%	0.41	0.27	10.75	2.18	13.61
Others	F	44	5	29	9	87
	%	5.99	0.68	3.95	1.22	11.84
Total	F	154	185	201	195	735
	%	20.95	25.17	27.35	26.53	100.0

F = frequency, % = percentage.

serve as a stress factor and favour infection. Also, the continued exposure to array of infectious agents and wild birds, nutritional deficiencies, the absence of disease control through vaccination, contact of birds of one rural area with those of another rural area through gift and sale of rural chickens which in some cases are diseased or carriers of some diseases may facilitate the spread of diseases like ND among flocks.

The high percentage of the chickens sampled that were at risk (86.2%) of being infected with NDV could also be due to the virulence of the strain causing the outbreak. In the neighboring state of Kaduna, Nwanta *et al.* (2006)

reported a prevalence of 73.3%. In most cases rural chickens are kept together with other breeds of poultry like guinea fowls, ducks, etc. These species of poultry may serve as carriers of diseases like ND. For example, a study conducted by Mai *et al.* (2004) in Plateau State indicated that, out of 165 serum samples collected from live birds market, ducks (6.7%) had antibodies against the ND virus. Similarly, out of the 205 serum samples collected from guinea fowls, 13.6% had antibodies against the ND virus and all sera from the ducks and guinea fowls were negative for IBD antibodies. It was concluded that both local ducks and guinea fowls had

been exposed to the NDV but not to the infectious bursal disease virus.

Only 14.1% of chickens had antibody titres  $\geq 4\log_2$  which was considered as protective, probably be due to exposure of the birds to the virus as a result of ND outbreak or contact with infected or vaccinated birds. This is in accordance with the reports of Martin (1992) and Adu *et al.* (1986) who reported that velogenic NDV was responsible for the majority of ND outbreaks in rural poultry and that velogenic strains of NDV were prevalent in traditionally managed poultry.

The control of diseases in rural poultry is made difficult because of the multi age structure of the flocks, small size of the flocks, the labour in catching individual birds for vaccination and the inefficient use of the vaccines (Alders and Spradbrow, 2001). In many countries, seasonal outbreaks of ND are recognized. Attempt was often made to attribute these outbreaks to the weather conditions prevalent at the time. Season of outbreaks of ND in rural chickens in the study area revealed that ND occurs all year round with more outbreaks occurring from November to March (Dry season). Sa'idu *et al.* (2006) and Nwanta *et al.* (2006) reported that increased movement of sick and healthy chickens in anticipation of various festivals particularly of Sallah, Christmas and New Year festivities may have been responsible for the peaks of ND outbreaks within this period (November-March). Also, movement of infected chickens which may mix with healthy ones is probably the main source of NDV. In many countries, veterinary workers, extension workers and indeed rural people, recognize that the introduction of new birds to a flock is often associated with an outbreak of ND (Alders and Spradbrow, 2001). This information needs to be spread by extension workers, although it is not possible to restrict the entry of new chickens into rural flocks. The windy harmattan also encourages the spread of the NDV. This agrees with the reports of Alders and Spradbrow (2001); Saidu *et al.* (2006) that cold weather induces stress on chickens and subsequently lower their immunity to ND. Although, farmers could not give the scientific name for common diseases affecting their flocks, they were able to describe the symptoms of these diseases based on which the highlighted diseases were identified. The major clinical signs observed by farmers for sick rural chickens suspected of suffering from ND were nervous signs, weakness, whitish/greenish diarrhea and coughing/sneezing. This is in agreement with reports of Alexander (1997) that clinical signs and the speed at which the signs appear vary widely and depend upon infectivity and dose of virus, the species, age and immune status of the host, environmental conditions and the route of exposure.

**Conclusion:** In conclusion this study has shown that the prevalence of NDV in the four LGAs of Plateau State is

high. At the time of the study, over 80% of rural chickens in Plateau State were at risk of dying of ND when exposed to a virulent NDV. It is therefore recommended that vaccination with ND vaccines especially thermostable vaccines (NDV<sub>1</sub> or NDV<sub>4</sub>) for rural chickens as a means of protecting birds against ND before the period of outbreaks should be instituted.

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