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Retrospective analysis of Newcastle disease diagnosed at the poultry clinic of Ahmadu Bello University, Zaria, Nigeria

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Abstract

Newcastle disease (ND) is a highly contagious viral disease of domestic and wild birds with devastating impact on poultry health and production. Many vaccines and vaccination schedules are in use in controlling the disease but prevention and control are still a problem. A ten-year retrospective study (2002-2011) of Newcastle disease and other poultry diseases diagnosed at the Poultry Clinic of Ahmadu Bello University Veterinary Teaching Hospital (ABUVTH), Zaria, Kaduna, Nigeria was conducted. Out of 2,649 cases of poultry presented, 43.9% (1,164 cases) were confirmed as ND. The highest number of cases of the disease was in August followed by July and May. The cases of ND were observed to be higher in the rainy season (July to September), but it seems to be 1.43 times more likely to occur during pre-dry season (October to December). Most of the cases of ND were recorded in chickens and turkeys. Birds between the ages of 9 and 20 weeks were 2.01 times more likely to suffer from ND than younger birds. Most of the cases of ND were reported in birds that were vaccinated against ND than non-vaccinated ones. It was recommended that monitoring of Newcastle disease antibody titre should be intensified during rainy season and birds should be vaccinated against the disease as at when due.

Keywords: Newcastle disease, Poultry, Seasonal distribution, Vaccine, Zaria

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Introduction

Newcastle disease is an economically important disease of poultry for which vaccination is carried out as a preventive measure in many countries. Nevertheless, outbreaks have been reported in vaccinated poultry populations (Van Boven *et al*., 2008). The emergence and identification of new sub-lineages gives an insight to the high rate of genetic drift occuring in Newcastle disease virus (NDV) strains in Nigeria and therefore raises concerns about the efficacy of current NDV control measures in the country (Solomon *et al*., 2012; Snoeck *et al*., 2013). Vaccination is practiced widely and different types of vaccines are available but the most successful and widely used are the mild live virus vaccines known as the Hitchner B_1 and La Sota types (Rathore *et al*., 1987; Aliyu *et al*., 2014).

Newcastle disease alone accounts for more than 50% of total losses in Africa's poultry flocks (Ezeibe *et al.,* 2006; Musa *et al.,* 2009). In fact, it has been argued that ND may represent a bigger drain on the world economy than any other animal viral disease (Alexander & Senne, 2008). It was first documented in Nigeria in 1952 in Ibadan (Hill *et al.,* 1953). Since then, the disease has become the most important viral disease of chickens and widely spread throughout the country with annual epidemics being recorded in highly susceptible poultry flocks (Halle *et al.,* 1999; Orajaka *et al.,* 1999; Sa'idu *et al.,* 2006). In response to the threat presented by ND, several attempts have been made to put in place vaccination programmes to prevent epidemics of disease (Adu *et al.,* 1986; Spradbrow, 1993). However, outbreaks have been reported in vaccinated populations (Okwor *et al.,* 2010).

Newcastle disease is still the single greatest constraint on the production of village poultry (Spradbrow, 1993; Kitalyi, 1998; Alexander, 1988; Alders & Spradbrow, 2001). It is endemic in village

poultry populations in Africa and Asia. Serological surveys indicate the presence of the virus in village poultry in countries throughout these continents, and where virus isolation has been attempted, virulent strains have been found (Echeonwu *et al.,* 1993; Snoeck *et al.*, 2013). Retrospective studies of clinical case reports across Nigeria showed that ND is the most common poultry disease. The high genetic diversity of the virus could have contributed to the increasing rate of the disease. This study was conducted to investigate cases of Newcastle disease presented and diagnosed at the Veterinary Teaching Hospital Ahmadu Bello University Zaria from 2002 – 2011, and also to provide information with regards to strategic control measures of ND within the study area.

Materials and methods

Study area

All the cases studied were from farms or households in northwestern Nigeria and presented to the Poultry Health Clinic of ABUVTH Zaria. The northwest region is located between latitudes 10° N and 13° 58' N; and longitudes 4° 8'E and 9° 54' E (Imo & Ikpenyong, 2011). The area is characterized by average annual rainfall of less than 1000 mm, with a prolonged dry season (7 months) and average daily temperature ranges from 30 – 40°C (Imo & Ikpenyong, 2011). The dominant vegetation is fewer trees like *Azadirachta indica, Parkia biglobasa* and shorter grasses such as cereals and so on (Muhammad & Musa, 2005). It is by far the most densely human populated zone of northern Nigeria (Muhammad & Musa, 2005).

Data collection and data management

Ten year records (January 2002 to December 2011) of cases diagnosed at the Poultry Clinic of ABUVTH, Zaria, Nigeria. The date, age, flock size, breed, species, vaccination history, feed source, management system and results on diagnosis of diseases were extracted from the clinic record books. Postmortem examination, microbiology and haemagglutination activity of tracheal swabs or serology (haemagglutination inhibition test) was usually conducted on any presented dead and/or live birds of the same flock respectively. A case was defined based on history, clinic findings, postmortem findings, and laboratory results in ABUVTH, Zaria.

Information on ND cases was extracted from the records and non-ND cases were considered as a group. The ages of the birds were categorized as follows: 0-8 weeks (chicks), 9-20 weeks (growers), and above 20 weeks (adults) for the chicken. The species of birds were chicken, duck, emu, guinea fowl, geese, ostrich, parrot, peafowl, pigeon, quail and turkey. The season in Zaria were categorized as dry season (January to March), pre-rainy season (April to June), rainy season (July to September), and pre-dry season (October to December) (Sa'idu *et al*., 1994).

Statistical analysis

The data were analysed using statistical package for social sciences (SPSS) version 16 (SPSS Inc, Chicago IL, USA) (SPSS, 2007). The specific rate for each of the factor was determined as the number of ND cases divided by the number of total case per category. The odds ratios (ORs) and 95% confidence interval on the odds ratios were also calculated for all the factors to determine the significance and strength of association between each factor and ND. The odds ratios were calculated with respect to reference category as indicated in respective tables.

Results

A total of 2, 649 cases of poultry diseases were documented in Poultry Clinic of ABUVTH with 1,164 (43.9%) of the cases diagnosed as ND over the ten year period (January, 2002 to December, 2011), giving an average of 116 ND cases per year. The year-specific rate for ND was highest in 2011 (50.2%) and lowest in 2005 (37.7%). However, only the odds ratios (ORs) for 2004 (1.28), 2009 (1.15) 2010 (1.29) and 2011 (1.46) were significant at 95% confidence interval with the number of ND cases of 109 (9.4 %), 182 (15.6 %), 175 (15.0 %) and 146 (12.5 %) respectively. Furthermore, there was a steady increase in the number of cases presented from 2005 to 2009, (Table 1).

The number of ND cases recorded was highest in August 129 (11.1 %) and lowest in November 64 (5.5 %). The highest month-specific rate of 54.7 % was observed in December 88 (7.6 %) and lowest in June (37.5 %) and September (37.7 %) having number of ND cases of 102 (8.8 %) and 98 (8.4 %) respectively, but only the ORs of January 92 (7.9 %), February 73 (6.3 %), March 85 (7.3), May 123 (10.6), August 129 (11.1), October 94 (8.1 %), November 64 (5.5 %) and December 88 (7.6 %) were significant at 95 % CI (Table 2).

The season-specific rates for pre-dry 246 (21.1 %) and dry 250 (21.5 %) seasons were 49.3 % and 48.0 % respectively and 41.7 % and 40.4 % for pre-rainy 316 (27.1 %) and rainy 352 (30.2 %) seasons respectively. However, the ORs of pre-dry (1.43) and dry seasons (1.36) were significant at 95 % CI (Table 3).

Table 1: Yearly distribution of Newcastle disease cases and non-Newcastle disease cases diagnosed at Ahmadu Bello University Veterinary Teaching Hospital (2002-2011)

Year	ND cases (%)	Non-ND cases (%)	Total (%)	Year specific rates (%)	OR	95 % CI
2002	121 (10.4)	175 (11.8)	296 (11.2)	40.9	1.00**	0.72 - 1.39
2003	50 (4.3)	66 (4.4)	116 (4.4)	43.1	1.10	0.71 - 1.69
*2004	109 (9.4)	123 (8.3)	232 (8.8)	47.0	1.28	0.91 – 1.81
2005	66 (5.7)	109 (7.3)	175 (6.6)	37.7	0.88	0.60 – 1.29
2006	76 (6.5)	104 (7.0)	180 (6.8)	42.2	1.06	0.73 – 1.54
2007	105 (9.0)	145 (9.8)	250 (9.4)	42.0	1.05	0.74 – 1.47
2008	134 (11.5)	194 (13.1)	328 (12.4)	40.9	1.00	0.73 – 1.38
*2009	182 (15.6)	228 (15.4)	410 (15.5)	44.4	1.15	0.85 – 1.56
*2010	175 (15.0)	196 (13.2)	371 (14.0)	47.2	1.29	0.95 – 1.76
*2011	146 (12.5)	145 (9.8)	291 (11.0)	50.2	1.46	1.05 – 2.02
Total	1,164	1,485	2,649 (100)	43.9		

*Significant at $p \leq 0.05$
**Reference category

Table 2: Monthly distribution of Newcastle disease cases and non-Newcastle disease cases diagnosed at Ahmadu Bello University Veterinary Teaching Hospital (2002-2011)

Month	ND cases (%)	Non-ND cases (%)	Total (%)	Month specific rates (%)	OR	95 % CI
*January	92 (7.9)	92 (6.2)	184 (6.9)	50.0	1.67	1.14 – 2.44
*February	73 (6.3)	66 (4.4)	139 (5.2)	52.5	1.84	1.22 – 2.79
*March	85 (7.3)	113 (7.6)	198 (7.5)	42.9	1.25	0.86 – 1.82
April	91 (7.8)	135 (9.1)	226 (8.5)	40.3	1.12	0.78 – 1.61
*May	123 (10.6)	137 (9.2)	260 (9.8)	47.3	1.50	1.06 – 2.11
June	102 (8.8)	170 (11.4)	272 (10.3)	37.5	1.00**	0.71 – 1.42
July	125 (10.7)	189 (12.7)	314 (11.9)	39.8	1.10	0.79 – 1.54
*August	129 (11.1)	168 (11.3)	297 (11.2)	43.4	1.28	0.91 – 1.79
September	98 (8.4)	162 (10.9)	260 (9.8)	37.7	1.00	0.71 – 1.43
*October	94 (8.1)	112 (7.5)	206 (7.8)	45.6	1.40	0.96 – 2.02
*November	64 (5.5)	68 (4.6)	132 (5.0)	48.5	1.57	1.03 – 2.39
*December	88 (7.6)	73 (4.9)	161 (6.1)	54.7	2.01	1.35 – 2.98
Total	1,164 (100)	1,485 (100)	2,649 (100)	43.9		

*Significant at $p \leq 0.05$
**Reference category

Table 3: Seasonal distribution of Newcastle disease cases and non-Newcastle disease cases diagnosed at Ahmadu Bello University Veterinary Teaching Hospital (2002-2011)

Season	ND cases (%)	Non-ND cases (%)	Total (%)	Season specific rates (%)	OR	95 % CI
*Dry (Jan-Mar)	250 (21.5)	271 (18.2)	521 (19.7)	48.0	1.36	1.09 – 1.69
Pre-rainy (Apr-Jun)	316 (27.1)	442 (29.8)	758 (28.6)	41.7	1.05	0.86 – 1.28
Rainy (Jul-Sept)	352 (30.2)	519 (34.9)	871 (32.9)	40.4	1.00**	0.83 – 1.21
*Pre-dry (Oct-Dec)	246 (21.1)	253 (17.0)	499 (18.8)	49.3	1.43	1.15 – 1.79
Total	1,164 (100)	1,485 (100)	2,649 (100)	43.9		

*Significant at $p \leq 0.05$
**Reference category

Table 4: Species distribution of Newcastle disease cases and non-Newcastle disease cases diagnosed at Ahmadu Bello University Veterinary Teaching Hospital (2002-2011)

Species	ND cases (%)	Non-ND cases (%)	Species specific rates (%)	Total (%)	OR	95 % CI
Chicken	1,114 (95.7)	1,398 (94.1)	44.3	2512 (94.8)	1.00**	0.89 – 1.11
*Duck	2 (0.2)	2 (0.1)	50.0	4 (0.2)	1.25	0.18 – 8.9
Emu	1 (0.1)	2 (0.1)	33.3	3 (0.1)	0.63	0.06 – 6.91
*Guinea fowl	1 (0.1)	1 (0.1)	50.0	2 (0.1)	1.25	0.08 – 20.09
Geese	2 (0.2)	5 (0.3)	28.6	7 (0.3)	0.50	0.10 – 2.60
Ostrich	1 (0.1)	6 (0.4)	14.3	7 (0.3)	0.21	0.03 – 1.74
Parrot	1 (0.1)	6 (0.4)	14.3	7 (0.3)	0.21	0.03 – 1.74
*Peafowl	3 (0.3)	2 (0.1)	60.0	5 (0.2)	1.88	0.31 – 11.29
Pigeon	1 (0.1)	2 (0.1)	33.3	3 (0.1)	0.63	0.06 – 6.93
*Quail	2 (0.2)	2 (0.1)	50.0	4 (0.2)	1.25	0.18 – 8.92
Turkey	36 (3.1)	59 (4.0)	37.9	95 (3.6)	0.77	0.50 – 1.18
Total	1,164 (100)	1,485 (100)	43.9	2649 (100)		

*Significant at $p \leq 0.05$
**Reference category

Table 5: Age distribution of Newcastle disease cases and non-Newcastle disease cases diagnosed at Ahmadu Bello University Veterinary Teaching Hospital (2002-2011)

Age (weeks)	ND cases (%)	Non-ND cases (%)	Total (%)	Age specific rates (%)	OR	95 % CI
chicks (0-8)	280 (24.1)	514 (34.6)	794 (30.0)	35.3	1.00**	0.81 – 1.23
Growers *(9-20)	328 (28.2)	299 (20.1)	627 (23.7)	52.3	2.01	1.63 – 2.49
Adults *(above 20)	556 (47.8)	672 (45.3)	1228 (46.4)	45.3	1.52	1.26 – 1.83
Total	1,164 (100)	1,485 (100)	2,649 (100)	43.9		

*Significant at $p \leq 0.05$
**Reference category

Table 6: Distribution of Newcastle disease cases and non-Newcastle disease cases diagnosed at Ahmadu Bello University Veterinary Teaching Hospital (2002-2011) based on Newcastle disease vaccination history

ND Vaccination history	ND cases (%)	Non-ND cases (%)	Total (%)	Vaccination specific rates (%)	OR	95 % CI
*Yes	965 (82.9)	1,152 (77.6)	2,117 (79.9)	45.6	1.40	1.15 – 1.70
No	199 (17.1)	333 (22.4)	532 (20.1)	37.4		
Total	1,164 (100)	1,485 (100)	2,649 (100)	43.9		

*Significant at $p \leq 0.05$

The species-specific rate showed that peafowl had the highest rate (60 %) followed by duck, guinea fowl, and quail with (50 %) each. The ND cases of 1,114 (95.7 %) and 36 (3.1 %) were recorded in chickens and turkeys respectively. The ORs of duck (1.25), guinea fowl (1.25), peafowl (1.88), and quail (1.25) were significant at 95 % CI compared to chickens and others species (Table 4).

Three hundred and twenty eighty (28.2 %) cases of ND were recorded in birds between the ages of 9 and 20 weeks, while 280 (24.1 %) cases were recorded in birds between the ages of 0-8 weeks, (Table 5). Nine hundred and sixty five (82.9 %) and 199 (17.1 %) cases of ND were recorded in vaccinated and unvaccinated birds respectively (Table 6).

Discussion

The proportion of 43.9% of ND obtained in this study was higher compared to what was reported by Abdu *et al.* (1985), Halle *et al*. (1999) and Sa'idu *et al*. (2006) of 19.5 %, 31.2 % and 32.3% respectively, which indicated increasing number of ND cases in relation to other poultry diseases presented to ABUVTH, Zaria. This might be due to increased awareness in the need for reporting disease outbreaks as a result of enlightenment following avian influenza (AI) outbreak in the previous years (2006 - 2008). The percentages of ND cases observed in the years 2002, 2008, 2009, 2010, and 2011 indicates that ND cases occurred more frequently within these years. However, the steady increase in the number of cases presented from 2005 to 2009 could be ascribed to the

disease consciousness by poultry farmers following avian influenza outbreaks. This is because disease control measures can only be properly employed when diseases are being reported to the appropriate authorities. The national strike embarked by the Nigerian Universities in the year 2003 accounted for the low number of cases presented to the ABUVTH. This may explain the lowest number of cases of ND in 2003.

The results showed that ND occurred more frequently in the month of May, July and August as against what was reported by Halle *et al*. (1999), Sa'idu *et al*. (2006), Sadiq *et al*. (2011), and Olabode *et al*. (2012), that ND outbreaks usually peak during the months of October, November, December and January. The high prevalence obtained in May, may be due to high environmental temperature recorded in this month in this part of the country. High environmental temperature can inactivate the virus by direct ultraviolet rays but usually precipitates diseases due to immunosuppressive effects of heat stress through the release of cortisol. The results also showed that the difference between ND in the dry season and in the rainy season was significant. The findings in this study are not in agreement with reports made by Sa'idu *et al*. (1994) and Halle *et al*. (1999) on the seasonality of ND, which revealed that the highest prevalence of the disease occurs between October and March, possibly because of the cold weather with high wind velocity (Abdu *et al.,* 1992).

Despite a high specie-specific rate for peafowl, the percentage of ND cases for chickens was highest compared to others species. This agreed with the report that chickens are the most susceptible species to ND, but the disease was also reported in guinea fowls and turkeys (Okaeme, 1983; Haruna *et al.,* 1993; Mohammed *et al.,* 1996). The percentage of ND (37.9 %) recorded in turkey is higher than what was reported by Halle *et al.* (1999) and Sa'idu *et al*. (2006). This can be as a result of increased turkey production during the period under review. Another reason can also be that poultry farmers are more enlightened about the need for reporting disease outbreak to the clinic. It can be deduced that the high prevalence in the layers may be due to arbitrary vaccination of birds within the egg production period. Some poultry farmers adapt self-developed vaccination programme which is not a product of any scientific investigation, but rather what seems to be yielding result for them. In view of this, erratic vaccination programmes are being followed dogmatically by poultry farmers.

The higher outbreaks of ND in vaccinated birds may be because most of the vaccines used are sourced from unreliable vaccine distributors in which adequate storage facilities are a problem as a result of irregular power supply. Most of the vaccine sellers hardly use ice pack at any point in time that would help to maintain vaccine cold chain from the vaccine source to point of usage. Exclusive dependence on the erratic power supply for vaccine storage may lead to vaccine failure (Okwor *et al.,* 2009). The availability of poor quality vaccines and presence of rampant unreliable vaccination schedules against ND could have contributed to the increase rate of the disease. In view of that, unregulated immunization of exotic chickens with live lentogenic and mesogenic vaccines (Ibu *et al.,* 2002; Ibrahim *et al.,* 2005). Therefore, birds might succumb to the condition due to confounding of the vaccination protocol.

In conclusion, newcastle disease is increasingly becoming a major obstacle to poultry farmers in northwestern Nigeria. It appears that the trend of ND is more likely to occur in pre-dry and dry seasons than pre-rainy and rainy seasons. Chickens still remain the most susceptible bird species to ND followed by turkeys. The waterfowls (ducks and geese) known to exhibit subclinical infection are now showing clinical disease condition. The vaccination carried out to prevent ND seems to be ineffective for the high rate of cases reported from the vaccinated flocks. Poultry farmers should ensure that birds are vaccinated against ND in accordance with the recommended vaccination programme. Therefore, there is need for continuous surveillance and characterization of NDV from the study area to monitor the emergence of new subgenotypes or identification of a potential NDV vaccine candidate.

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