



Prevalence of Newcastle Disease in Gombe, Northeastern Nigeria: A Ten-Year Retrospective Study (2004 – 2013)

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Authors' contributions

This work was carried out in collaboration between all authors. Authors JRL and SMJ conceived and designed the study, wrote the protocol and first draft of the manuscript. Authors YAG and UII were the mentors and gave professional advice with proof reading of the final draft. Authors AMB and IAG contributed in literature search. Authors MM and YW contributed in data retrieval, management and statistical analysis. All authors read and approved the final manuscript.

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ABSTRACT

Aim: A ten – year retrospective study was conducted with the aim to determine the prevalence of Newcastle Disease (ND) in relation to other poultry diseases diagnosed in the State area veterinary clinics.

Study Design: Retrospective study.

Place and Duration of the Study: This study was conducted in Gombe State, Northeastern Nigeria. Case files from Tashan Dukku and Pantami area veterinary clinics in Gombe metropolis were reviewed for the study. File of cases of poultry diseases reported between January 2004 and December 2013 were studied.

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Methodology: Information on ND in poultry only was extracted from the clinical records and the non – ND cases were considered together as a group. A case of ND was defined as a farm that reported an outbreak of diseases diagnosed as ND based on history, clinical signs and post – mortem findings in the study area.

Results: Of 9970 cases of poultry diseases studied, 5531 (55.50%) were cases of ND ($P > 0.05$). The Year Specific Rate (YSR) ranged from 51.5% (OR = 1.0) in 2005 to 63.3% (OR = 1.63; 95%CI: 0.81 – 2.45) in 2006 ($P > 0.05$). The Monthly Specific Rates (MSR) of ND was 66.5% (OR = 5.94; 95%CI: 4.57 – 7.31) in October, 64.4% (5.42; 4.29 – 6.55) in December, 64.2% (5.36; 4.17 – 6.55) in January, 61.3% (4.74; 3.61 – 5.87) in November, 27.0% (1.10; 0.15 – 2.05) in June and 25.1% in July. ND was 3.4 times more likely to occur during the Pre-dry season (October – December) and 3.0 times more likely to occur during the Dry season (January - March) as compared with the other seasons of the year.

Conclusion: The study revealed that ND is still endemic in Gombe State – Nigeria, with peak outbreaks during dry and cold seasons. Purchasing day old chicks from farms known to give booster vaccinations to their parent stock hens, vaccinating chicks with vaccines that are immunogenic, use of thermo-stable vaccines for routine vaccinations of chicks and maintenance of strict bio-security measures are recommended to reduce the prevalence of the disease in the study area.

Keywords: Retrospective study; Newcastle disease; prevalence rate; gombe; Northeastern Nigeria.

1. INTRODUCTION

Poultry sector is one of the most important Agricultural sectors in Nigeria, providing animal proteins such as meat and eggs to man as well as contributing to the national income through revenue [1]. Nigeria has an estimated poultry population of 140 million with backyard poultry production accounting for more than 60% of the total flock with an asset value of > 5.75 billion US Dollars [1]. In recent years, the poultry industry in Nigeria has faced major constraints ranging from diseases, poverty and political factors to insecurity problems bedeviling the Northeastern region. Among the diseases, Newcastle disease (ND), one of the most important avian viral diseases ranks high [2].

ND caused by a virus of genus *Avulovirus*, subfamily Paramyxovirinae of the family Paramyxoviridae, is an acute, highly contagious rapidly spreading viral disease of domestic poultry and other wild species of birds of all ages [3,4,5,6]. It is considered to be among the most important viral diseases of poultry worldwide and a major constraint to successful poultry production in developing countries like Nigeria [7,8]. It results in huge economic losses to commercial poultry industries [9,10,11] and village chicken production systems worldwide [12,13]. The *Newcastle Disease Virus* (NDV) had been reported endemic in many developing countries of Africa such as Kenya [14,15]; Cameroon [16,17]; Tanzania [12]; Ethiopia [18]; Egypt [19] and Nigeria [20,21,22,23,24,25].

The first documented confirmed outbreak of ND in Nigeria occurred between December 1952 and

February 1953 in and around Ibadan [26]. The disease has since that time remained a major threat to the Nigerian poultry industry [27]. An average of 200 – 250 outbreaks of ND is reported annually in Nigeria [28,29,24]. It still remains a major constraint to successful poultry production in Nigeria with outbreaks resulting to up to 100% mortalities [30,31].

Gombe State is one of the States in the Northeastern region of Nigeria located at the centre in the region. Considering the movement of people into the state from neighbouring Borno, Yobe and Adamawa states seeking safety, shelter, food and refuge against the backdrop of insurgency that threatens lives and properties of the populace of the region, there is an urgent need to boost poultry production (meat and eggs) and protect the commercial poultry farms in the state to meet up with the high demands of protein from animal origin resulting from this influx. There is currently dearth of information on the prevalence of ND in the study area. Therefore, this study was carried out to determine the prevalence and seasonal occurrence of ND using ten – year case records (2004 – 2013) diagnosed at the Tashan Dukku and Pantami area veterinary clinics) in Gombe State, Northeastern Nigeria.

2. MATERIALS AND METHODS

2.1 Study Area

The study was conducted in Gombe State, which is located in the Northeastern region of Nigeria and shares an extensive border with Bauchi, Adamawa, Yobe, Borno and Taraba States. It is

located at $10^{\circ}15^1$ - 10.250° North Latitude and $11^{\circ}10^1$ - 11.167^1 East Longitude. It has an area of 20,265 Km² and a population of about 2,353,000 (2006 census figures). It has a mean annual rainfall of 818.5mm, temperature range of 12 – 37°C and relative humidity of 94% in August and 10% in December. Cold harmattan starts in October. The season in Gombe like in most parts of Northeastern Nigeria is categorized as follows: Dry season (January - March), Pre-rainy season (April - June), Rainy season (July-September) and Pre-Dry season (October –December) [32].

2.2 Data Collection

Data were collected from the State veterinary clinics' record in Gombe State from January 2004 to December 2013. Information on ND in poultry only was extracted from the clinical records and the non – ND cases were considered together as a group. A case of ND was defined as a farm that reported an outbreak of a disease which was diagnosed as ND based on history, clinical signs and post – mortem findings in the veterinary clinics in Gombe metropolis council.

2.3 Data Analysis

Descriptive analyses were conducted by Microsoft office Excel spread sheet, Odds Ratios (OR) and 95% CI on the OR were calculated to determine strength and significance of associations between variables and prevalence of ND using Graphpad prism® version 5.01 for windows (GraphPad Software, Inc., San Diego, California, USA) computer based program. The seasonal variation in the distribution of ND for the study period was determined by reducing the ten

– year data to one year using the 4 season's ratios to moving average method [33].

3. RESULTS

A total of 9, 970 cases of poultry diseases were recorded in the Pantami and Tashan Dukku area veterinary clinics, Gombe state during the study period (2004 – 2013). Of these cases, 5531 (55.5%) were diagnosed as ND. This was not statistically significant ($P < 0.05$). The Year Specific Rates (YSR) of ND ranged from 51.5% (OR = 1.00) in 2005 to 63.3% (OR = 1.63; 95%CI: 0.81 – 2.45) in 2006 (Table 1). The odd ratios for all the years were not statistically significant at 95% CI ($P > 0.05$). Table 2 presents the Monthly Specific Rates (MSR) for the ND during the study period. It was observed that ND occurred all the year round during the study period. The MSR was 66.5% (OR = 5.94; 95%CI: 4.57 – 7.31) in October, 64.4% (5.42; 4.29 – 6.55) in December, 64.2% (5.36; 4.17 – 6.55) in December, 61.3% (4.74; 3.61 – 5.87) in November, 27.0% (1.10; 0.15 – 2.05) in June and 25.1% in July (Table 2, Fig. 1). This was statistically significant ($P < 0.05$) at 95% CI for the months of January, February, March, September, October, November and December (Table 2, Fig. 1). The Season Specific Rate (SSR) of ND varied from 34.4% in Pre-rainy (April – June) to 64.0% in Pre-dry (Oct – Dec). ND was 3.4 and 3.0 times more likely to occur during the Pre-dry (October – December) and Dry (January – March) periods respectively (Table 3). The seasonal variation of ND in the study area showed that ND peaked during the pre-dry and dry seasons of all the years (2004 – 2013) (Fig. 2). The highest peak was observed in pre-dry season and the lowest in pre-rainy season (Fig. 2).

Table 1. Yearly distribution of Newcastle disease in Gombe State, Northeastern Nigeria (2004 – 2013)

Year	Total no. of cases	Cases of ND ^a	YSR ^b (%)	OR ^c	95% CI ^d
2004	975	526	54.0	1.11	0.45 – 1.77
2005	826	425	51.5	1.00	-
2006	915	579	63.3	1.63	0.81 – 2.45
2007	928	486	52.4	1.04	0.39 – 1.69
2008	810	472	58.3	1.32	0.53 – 2.11
2009	1071	566	52.9	1.06	0.45 – 1.67
2010	1052	614	58.4	1.32	0.63 – 2.01
2011	1180	671	56.9	1.24	0.61 – 1.87
2012	1128	593	52.6	1.05	0.46 – 1.64
2013	1085	599	55.2	1.16	0.52 – 1.80
Total	9970	5531	55.5		

^a Newcastle Disease; ^b Year Specific Rates (%); ^c Odds ratio; ^d 95% Confidence Interval on OR

Table 2. Monthly distribution of Newcastle disease in Gombe state, Northeastern Nigeria (2004 – 2013)

Month	Cases of ND ^a	Cases of non-ND	MSR ^b (%)	OR ^c	95% CI ^d
Jan.	885	494	64.2	5.36	4.17 – 6.55
Feb.	695	490	58.6	4.24	3.09 – 5.39
Mar.	312	282	52.5	3.31	1.87 – 4.75
Apr.	186	275	40.3	2.02	0.74 – 3.30
May	157	280	35.9	1.68	0.48 – 2.89
Jun.	124	336	27.0	1.10	0.15 – 2.05
Jul.	110	329	25.1	1.00	-
Aug.	97	224	30.2	1.30	0.06 – 2.54
Sep.	385	275	58.3	4.19	2.66 – 5.72
Oct.	757	381	66.5	5.94	4.57 – 7.31
Nov.	836	528	61.3	4.74	3.61 – 5.87
Dec.	987	545	64.4	5.42	4.29 – 6.55
Total	5531	4439	55.5		

^a Newcastle Disease; ^b Monthly Specific Rates (%); ^c Odds ratio; ^d 95% Confidence Interval on OR

Table 3. Seasonal distribution of Newcastle disease in Gombe, Northeastern Nigeria (2004-2013)

Season	Cases of ND ^a	Cases of non-ND	SSR ^b (%)	OR ^c	95% CI ^d
Dry (Jan-Mar)	1892	1266	59.9	2.85	2.27 – 3.43
Pre-rainy (Apr-Jun)	467	891	34.4	1.00	-
Rainy (Jul-Sep)	592	828	41.7	1.36	0.76 – 1.96
Pre-dry (Oct-Dec)	2580	1454	64.0	3.39	2.83 – 3.95
Total	5531	4439	55.5		

^a Newcastle Disease; ^b Season Specific Rates (%); ^c Odds ratio; ^d 95% Confidence Interval on OR

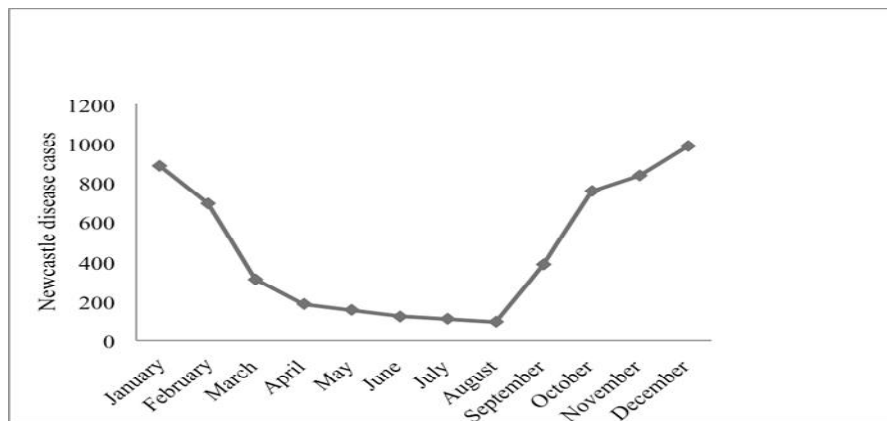


Fig. 1. Monthly distribution of Newcastle disease in Gombe, Northeastern Nigeria (2004 - 2013)

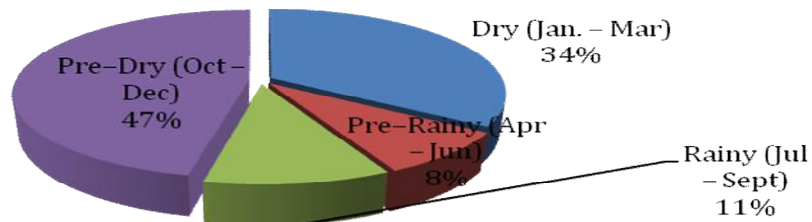


Fig. 2. Seasonal variation of Newcastle disease in Gombe, Northeastern Nigeria (2004-2013)

4. DISCUSSION

The major clinical signs observed for tentative diagnosis of sick birds suspected of suffering from ND were nervous signs, weakness, whitish/greenish diarrhea and coughing/sneezing at ante-mortem. This is in agreement with reports by Okoye et al. [34] and Abdu et al. [35] who confirmed similar signs as tentative in the diagnosis of ND in infected birds. Several studies reported that ND is endemic in Nigeria; in both village and exotic breeds of poultry with annual epidemics recorded in highly susceptible flocks [35,36,28]. It was reported prevalent in most parts of the Northern Nigeria with outbreaks seen in Bauchi State [37]; Borno State [38]; Jigawa State [39]; Nassarawa State [25]; Kaduna State [31] and Plateau State [22]. The present study revealed an overall prevalence rate of 55.5% of ND diagnosed during the study period in Gombe State, Northeastern Nigeria. This concurs with previous studies by Nwankiti et al. [37] who reported prevalence rate of 56.3% in Bauchi State, Northeastern Nigeria. However, it is relatively higher than the prevalence rates of 51.9% as reported by Musa et al. [22] in Plateau State; 52.2% reported by Sadiq et al. [40] in Borno State and lower than 73.3% reported by Nwanta et al. [31] in Kaduna State, Northwestern Nigeria. Most commercial poultry farmers in the study area claimed to have been vaccinating their flocks. However, in a situation where vaccinated birds still come down with ND; might reflect either vaccine failure – when a less potent vaccine was used and the birds were infected by a more virulent/pathogenic strain of the virus or vaccine break where a foreign strain of NDV might have been involved in the infection process. Geidam et al. [41] and Sa'idu and Abdu [28] both reported outbreaks of ND in vaccinated flock of Pullets in Maiduguri and Viscerotropic Velogenic form of ND in vaccinated six weeks old Pullets attributed to vaccine failure respectively. The complicated involvement of the village poultry and the role they play in the epidemiology and transmission of ND in the study area should not be ruled out. Outbreaks of ND had been reported to be more likely in farms that keep exotic birds with village chickens and other poultry species like ducks and turkeys [42]. This is further confirmed by the serological evidence of ND in various species of domesticated poultry in Nigeria [20,43,44,45]. In addition, several epizootiological studies incriminated village chickens as important factors in the transmission and enzootic maintenance of NDV in various localities [46]. This has indeed, given rise to the

speculation that apparently healthy free roaming birds including the village chickens, may play an important role in the transmission of Velogenic form of ND to commercial poultry farms in their neighborhood thus, giving rise to epizootics in these farms [47]. This suggested, the circulation of the disease even within the vaccinated poultry flocks in the study area. The results of the present study revealed that ND was endemic in the study area with the disease occurring all year round throughout the study period (Table 1). ND was two times more likely to occur in 2006 compared with the other years during the study period (Table 1). This might be due to farmers' awareness on the disease, which by implication means more cases are likely to be reported and therefore more ND cases might be diagnosed. ND was about five times more likely to occur during the months of September, October, November, December, January and February compared with other months during the study period (Table 2). This suggested that the disease is prevalent in months that made up the cold harmattan period of the year. This is consistent with the findings of Sa'idu et al. [33] and Nwanta et al. [31], where both reported the disease to be common during the dry harmattan period (November – March) with cold stress also been reported to exacerbate the epidemiology of the ND. Alders and Spradbrow [7] reported that the windy harmattan encourages the spread of the NDV. In addition, these months also coincided with the end of year festivities period (Christmas, New year and Boxing day) during which the movement of both village and exotic breeds of chickens is at peak. This suggested the perpetual ND transmission among birds in the same market place as well as chickens purchased for purposes of restocking. In Nigeria, seasonal outbreaks of ND were previously recognized and reported [22,24]. This study revealed outbreaks of ND were more common during the pre – dry and dry seasonal periods comprising the harmattan dry periods as reported worldwide (Fig. 2). Most outbreaks occurred in the village chicken flocks because they are usually exposed to harsh environmental conditions – They are poorly sheltered and rarely vaccinated against ND as observed by Musa et al. [22]. There is steady upsurge in the number of poultry cases reported in the study area from 2009 – 2013 (Table 1). This could be attributed to the public enlightenment on the disease reporting to nearest veterinary clinics and/or consultants to seek for professional interventions to curb disease outbreaks like ND encountered by the poultry farmers in the study area. This

means that the farmers would report more poultry disease outbreaks during these periods. It had been reported that clinically sick chickens are the primary host for NDV and they play a major role of transmitting the infection [47,48,15]. This study revealed that ND was endemic in the study area with more outbreaks seen in the pre – dry and dry periods of the year. This is consistent with previous studies of ND, which highlighted harmattan period and cold stress to play important roles in the transmission and maintenance of the NDV in Northern Nigeria.

5. CONCLUSION

This study revealed that ND was enzootic among the poultry population and still a major constraint to commercial poultry farming in the study area. This study provides a background reference point on the current distribution patterns of ND in the study area. Therefore, public enlightenment campaigns to poultry farmers engaged in commercial poultry business and local/backyard farmers on the economic importance of the disease is important in ameliorating the menace of ND outbreaks in the study area. Preventive measures such as rearing birds of different species and ages separately, quarantining newly purchased birds for restocking before mixing with other birds in the farms, purchase of day old chicks from reputable farms, acquiring vaccines from reputable sources, adhering to routine vaccination schedules using affordable and thermostable ND vaccines and observing strict biosecurity measures such as all-in all-out on their farms were suggested to curb the menace of NDV as this have bearing effects on the revenue generation and the viability of commercial poultry farming in Gombe state, Northeastern Nigeria.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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