
ABSTRACT

Aim: A ten – year retrospective study was conducted with the aim to determine the prevalence of Newcastle Disease (NCD) 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. The data for the present study were retrieved from case files from Tashan Dukku and Pantami area veterinary clinics located at strategic areas of the metropolis. This study utilizes poultry case records from January 2004 to December 2013.

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

Results: Of the 9970 cases, an overall prevalence rate of 55.5% (5531 cases) was recorded for NCD ($P >0.05$). The Year Specific Rate (YSR) ranges 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) was highest in October 66.5% (OR = 5.94; 95%CI: 4.57 – 7.31), November 61.3% (4.74; 3.61 – 5.87), December 64.4% (5.42; 4.29 – 6.55) and January 64.2% (5.36; 4.17 – 6.55) and lowest in June 27.0% (1.10; 0.15 – 2.05) and July 25.1%. The Season Specific Rate (SSR) of NCD varies from 34.4% in Pre-rainy (Apr – Jun) to 64.0% in Pre-dry (Oct – Dec). NCD is 3.4 and 3.0 times more likely to occur during the Pre-dry (Oct – Dec) and Dry (Jan-Mar) periods respectively.

Conclusion: This study reveals that NCD is still endemic, with peak outbreaks seen to occur during dry and cold harmattan periods as reported worldwide. Therefore, appropriate preventive measures such as purchase of day old chicks from reputable farms, acquiring vaccines from reputable sources, adhering to routine vaccination using thermostable NCD vaccines and observing strict biosecurity measures such as all-in all-out in farms were suggested.
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 industries in Nigeria have faced major constraints ranging from diseases, poverty and political factors to insecurity problems bedeviling the Northeastern region. Among these diseases, Newcastle disease (NCD), one of the most important avian viral diseases ranks high [2]. NCD 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 including 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) has been reported to be 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 NCD in Nigeria occurred between December 1952 and February 1953 in and around Ibadan [26]. The disease has since this time remained a major threat to commercial poultry industries in the country [27]. An average of 200 – 250 outbreaks of NCD is reported annually in Nigeria [28, 29, 24]. It still remains a major constraint to successful poultry production in Nigeria with outbreaks resulting up to 100% mortalities [30, 31]. Gombe state is one of the Northeastern states of Nigeria located at the central point in the Northeastern region. Considering the movement of people into the state from neighbouring Borno, Yobe and Adamawa states seeking safety, shelter, food and refuge against the insurgency that threatens lives and properties of the populace of the Northeastern region, there is an urgent need to boost poultry production (meat and eggs) and to protect the commercial poultry farms in the state to meet up with the high demand of protein from animal origin resulting from this influx. There is
currently dearth of information on the prevalence of NCD in the study area. Therefore, this study
was carried out to determine the prevalence and seasonal occurrence of NCD using ten – year
case records (2004 – 2013) diagnosed at the Gombe state veterinary clinics, 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°15' - 10.250° North Latitude and 11°10' - 11.167° 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 NCD in poultry only was extracted from the clinical records
and the non – NCD cases were considered together as a group. A case of NCD was defined as a
farm that reported an outbreak of a disease and diagnosed based on history, clinical signs and
post – mortem findings in the veterinary clinic 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 NCD using Graphad prism® version 5.01 for windows
(GraphPad Software, Inc., San Diego, California, USA) computer based program. The seasonal
variation in the distribution of NCD for the period 2004 – 2013 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 Gombe state veterinary clinics (Pantami and Tashan Dukku area veterinary clinics) during the study period (2004 – 2013). Of these cases, 5531 (55.5%) were diagnosed as NCD. This was not statistically significant ($P < 0.05$). The Year Specific Rates (YSR) for NCD ranges 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 NCD during the study period. It is observed that NCD occurred all the year round during the study period in the study area. The MSR was highest in October 66.5% (OR = 5.94; 95%CI: 4.57 – 7.31), November 61.3% (4.74; 3.61 – 5.87), December 64.4% (5.42; 4.29 – 6.55) and January 64.2% (5.36; 4.17 – 6.55) and lowest in June 27.0% (1.10; 0.15 – 2.05) and July 25.1% (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 NCD varies from 34.4% in Pre-rainy (Apr – Jun) to 64.0% in Pre-dry (Oct – Dec). NCD is 3.4 and 3.0 times more likely to occur during the Pre-dry (Oct – Dec) and Dry (Jan-Mar) periods respectively (Table 3). The seasonal variation of NCD in the study area showed that NCD peaked in 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)

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

$^a$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)

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

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

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

<table>
<thead>
<tr>
<th>Season</th>
<th>Cases of NCD&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Cases of non-NCD</th>
<th>SSR&lt;sup&gt;b&lt;/sup&gt; (%)</th>
<th>OR&lt;sup&gt;c&lt;/sup&gt;</th>
<th>95% CI&lt;sup&gt;d&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry (Jan-Mar)</td>
<td>1892</td>
<td>1266</td>
<td>59.9</td>
<td>2.85</td>
<td>2.27 – 3.43</td>
</tr>
<tr>
<td>Pre-rainy (Apr-Jun)</td>
<td>467</td>
<td>891</td>
<td>34.4</td>
<td>1.00</td>
<td>-</td>
</tr>
<tr>
<td>Rainy (Jul-Sep)</td>
<td>592</td>
<td>828</td>
<td>41.7</td>
<td>1.36</td>
<td>0.76 – 1.96</td>
</tr>
<tr>
<td>Pre-dry (Oct-Dec)</td>
<td>2580</td>
<td>1454</td>
<td>64.0</td>
<td>3.39</td>
<td>2.83 – 3.95</td>
</tr>
<tr>
<td>Total</td>
<td>5531</td>
<td>4439</td>
<td>55.5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup>Newcastle Disease; <sup>b</sup>Season Specific Rates (%); <sup>c</sup>Odds ratio; <sup>d</sup>95% Confidence Interval on OR
4. DISCUSSION

The major clinical signs observed for tentative diagnosis of sick birds suspected of suffering from NCD 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 confirm similar signs as tentative in the diagnosis of NCD in infected birds. Several studies reported that NCD 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 to be 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 reveals an overall prevalence rate of 55.5% of NCD 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 NCD, 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 NCD virus (NCDV) might have been involved in the infection process. Geidam et al. [41] and Sa’idu and Abdu [28] both reported outbreaks of NCD in vaccinated flock of Pullets in Maiduguri and Viscerotropic Velogenic form of NCD 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 NCD in the study area should not be ruled out. Outbreaks of NCD have 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 NCD 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 NCDV 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 virus of NCD 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 NCD is endemic in the study area, with the disease occurring all year round throughout the study period (Table 1). It is about 2 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 NCD cases might be diagnosed. It is also about 5 times more likely to occur during the months of September, October, November, December, January and February compared with the 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], who 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 NCD. Alders and Spradbrow [7] reported that the windy harmattan encourages the spread of the NCDV. 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 is at peak. This suggested the perpetual NCD transmission among birds in the same market place as well as chickens purchased for purposes of
restocking. In Nigeria, seasonal outbreaks of NCD were previously recognized and reported [22, 24]. The monthly trends of NCD revealed occurrence of peak outbreaks of the infection in the months of October, November, December and January (Fig. 1). This study reveals outbreaks of NCD were common in 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 NCD 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 encountered by the poultry farmers in the study area. This means that the farmers would report more poultry disease outbreaks during these periods. It has been reported that clinically sick chickens are the primary host for NCDV and they play a major role of transmitting the infection [47, 48, 15]. This study reveals that NCD is 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 NCD, which highlighted harmattan period and cold stress to play important roles in the transmission and maintenance of the NCDV in Northern Nigeria.

5. CONCLUSION

This study revealed that NCD is 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 NCD 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 NCD 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 NCD vaccines and observing strict biosecurity measures such as all-in all-out on their farms were suggested to curb the menace of NCDV as this have bearing effects on the revenue generation and the viability of commercial poultry farming in Gombe state of Nigeria.
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