Retrospective Studies of Marek’s Disease Diagnosed in Four States Across Nigeria

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Abstract

Studies on the prevalence of Marek's disease (MD) from veterinary clinics across Nigeria between 2000 and 2009 were investigated based on available poultry disease records. Of the 1,970 poultry viral diseases recorded, 1,193 (60.6%) were diagnosed for Marek’s disease. The mean age of birds diagnosed with MD included were, 319 broilers (7.8 weeks), 77 cockerels (15.0 weeks), 952 pullets (12.9 weeks), and 602 layers (29.9 weeks). The prevalence of MD was significantly higher (p < 0.05) among poultry aged 18 weeks and above (85.5%) compared to those aged 9 – 17 weeks (71.4%) and 5 - 8 weeks (25.3%), but least among 1-4 weeks (14.7%). Layers and pullets had higher prevalence of MD 86.7% and 62.1% respectively. The risk factors for MD using odds ratio association on age, type, region of the country, showed statistically significant associations; poultry aged 18 weeks and above were 34.3 times more likely at risk of having Marek’s disease compared to chicks aged 1 – 5 weeks. Compared to broiler, layer had the highest odds ratio of coming down with Marek’s disease (OR 31.3), followed by pullets (OR 7.9) and turkeys (OR 3.2). The probabilities of birds coming down with MD were significantly higher in the southern (OR 7.8) compared to northern part of Nigeria and slightly higher during the rainy season (OR 1.4) compared to dry season. The probability decreased in 2006 and 2007 (OR 0.7) but increased in 2008 and 2009 (OR 1.5 and 2.0 respectively). The importance of diagnostic surveillance of MD was discussed.

Keywords: Retrospective, marek’s disease, states, Nigeria.
Introduction

Marek's disease (MD) is a lymphoproliferative neoplasm of domestic fowl caused by herpesvirus and is a major disease problem and source of great economic loss in poultry (Witter and Schat, 2003). Prior to the discovery of MD vaccines, it can cause up to 60% mortality in laying birds and 10% condemnation in broilers (Witter and Schat, 2003). Despite the progress made from the use of vaccines to control the disease (Okazaki et al., 1970 and Purchase and Schultz, 1978) it continues to be a serious problem to the poultry industry worldwide. Witter (1997) attributed the likely cause of MD outbreaks in vaccinated flocks could be due to the evolution of virulent strains. In Nigeria, routine MD vaccination has not been fully adopted especially with local chickens, broilers and some commercial or improved breeds probably due to economic problem or difficulty to obtain the imported vaccines thereby making the control of disease very difficult (as observed Jwander, 2005). Adene (1983) reported that the poultry industry in Nigeria appeared to have benefitted from the spillover effects of the vaccination standard and practices from the poultry exporting countries. The pathological similarity between MD and Avian Leucosis (AL) which is another economically important neoplasm of poultry and the diagnostic surveillance of these diseases can be misleading (Adene, 1975; Adene and Akpavie, 2004). This nine-year retrospective study described MD and discussed the trend of MD incidence as recorded in the studied centres and the possible implications of these data on the epizootiology of MD as diagnosed.

Materials and Methods

Study Area

Selection of the study area in Nigeria was based on the likely source of reported MD due to long presence of veterinary teaching hospitals, clinics and diagnostic centres in strategic geographical locations of the country. Mokola veterinary centre and university of Ibadan veterinary teaching hospital Ibadan in Oyo state represented the western zone. Nsukka private veterinary Clinics and university of Nigeria Nsukka veterinary teaching hospital, Enugu state represented the eastern zone. Evangelical church Wining All (ECWA) veterinary clinic Bukuru in Plateau state represented the central zone and veterinary teaching hospital Ahmadu Bello university Zaria in Kaduna state represented the northern zone as indicated (Figure 1).

Fig. 1: Map of Nigeria showing States with Veterinary Hospitals and Clinics as points of data collection on Marek's disease (Map of study site was designed in ArcView GIS version 3.1).
Study Design

The retrospective study was based on poultry disease records from the veterinary teaching hospital (VTH’s) Ahmadu Bello University (ABU), Zaria, Kaduna State; University of Ibadan (UI) and Mokola state veterinary clinic, Ibadan, Oyo State; University of Nigeria Nsukka (UNN) and Nsukka private veterinary clinics, Enugu State and Evangelical Church Winning All (ECWA) veterinary clinic Bukuru, Plateau State Nigeria between February 2000 and July 2009 (Figure 1).

The choice of locations apart from geopolitical distributions, Kaduna represented the northern states, Plateau for the central states, Oyo for western and Enugu represented the eastern states of the country. The locations also have good poultry population (Kaduna 2,821,093 birds; Plateau 3,799,580 birds; Oyo 3,113,368 birds and Enugu with 3,723,326 birds as reported by Ministry of Agriculture, 2006) and the presence of long established veterinary services, which served as the referral points for this study.

The MD data collected involved disease outbreaks, age, and type of bird, dry and raining season, region of north and south; zones of north west, north central, south east, and south west. A prepared structured form was used in data collection, visits were made to veterinary clinics and hospitals, and relevant data on avian cases with viral disease diagnosis were extracted.

Case Definition

All cases for which the diagnosis of Marek’s disease were made by flock history, clinical signs, gross postmortem lesions, histopathological examination and antigen-antibody detection within the study period were selected as cases. Controls included other viral diseases of poultry diagnosed within the same study period for which MD was excluded.

Challenges

Retrospective laboratory diagnosis of MD virus to augment and confirm the field diagnosis such as antigen-antibody detection using, AGPT and ELISA for serology and PCR for antigen detection were not recorded by the clinicians MD during the studied period.

Statistical Analysis

Data collected were entered into excel spreadsheet for prevalence rate of MD. Data were further transferred into MedCal version 11.2. Analysis was carried to determine the odd ratio (OR) and relative risk (RR) among the variables such as, year, age, type of birds, seasons of the year, regions and zones for possible current status, cause and control measures.

Results

Year

Of the 1,970 poultry viral diseases recorded during the study period, 1,193 (60.6%; 95% CI: 58.4 – 62.7) were diagnosed with Marek’s disease. The risk of MD infection decreased in the year 2006 (OR 0.7; 95% CI: 0.5–0.9) and 2007 (OR 0.7; 95% CI: 0.5–1.0) compared with 2000 but increased in 2008 (OR 1.5; 95% CI: 1.1–2.2) and 2009 (OR 2.0; 95% CI: 1.2–3.4), (Table 1).

Table 1: Yearly (pooled) distribution of Marek’s disease diagnosed between, 2000-2009 in four states across Nigeria.

<table>
<thead>
<tr>
<th>Year</th>
<th>MDx / TVDx (Pr %)</th>
<th>Odds Ratio</th>
<th>95% C.I</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>120/200 (60.0)</td>
<td>1</td>
<td>RF</td>
<td></td>
</tr>
<tr>
<td>2001</td>
<td>75/162 (46.3)</td>
<td>0.6</td>
<td>0.4 - 0.9</td>
<td>0.0095</td>
</tr>
<tr>
<td>2002</td>
<td>26/26 (100.0)</td>
<td>35.4</td>
<td>2.1 - 589.3</td>
<td>0.0129</td>
</tr>
<tr>
<td>2003</td>
<td>106/160 (66.3)</td>
<td>1.3</td>
<td>0.9 - 2.0</td>
<td>0.2233</td>
</tr>
<tr>
<td>2004</td>
<td>39/40 (97.5)</td>
<td>26</td>
<td>3.5 - 193.1</td>
<td>0.0014</td>
</tr>
<tr>
<td>2005</td>
<td>42/44 (95.5)</td>
<td>14</td>
<td>3.3 - 59.5</td>
<td>0.0003</td>
</tr>
<tr>
<td>2006</td>
<td>274/552 (49.6)</td>
<td>0.7</td>
<td>0.5 - 0.9</td>
<td>0.0122</td>
</tr>
<tr>
<td>2007</td>
<td>106/212 (50.0)</td>
<td>0.7</td>
<td>0.5 - 1.0</td>
<td>0.0419</td>
</tr>
<tr>
<td>2008</td>
<td>324/466 (69.5)</td>
<td>1.5</td>
<td>1.1 - 2.2</td>
<td>0.0171</td>
</tr>
</tbody>
</table>
Age

The proportion of all poultry birds diagnosed with Marek’s disease was presented in Table 2. The age specific prevalence of Marek’s disease was higher among poultry aged 18 weeks and above (85.5%) compared to those aged 9 – 18 weeks (71.4%) and those aged 5 - 8 weeks (25.3%), but least among those aged 1-4 weeks (14.7%). The age relative risk showed that Poultry aged 18 weeks and above were 34.3 (95% CI: 22.5–52.1) times more likely at risk of infection with Marek’s disease compared to poultry age 1 – 5 weeks. Higher risk of MD were also observed with ages 9 – 18 weeks (OR 14.5; 95% CI: 9.8–21.5) and ages 5 – 8 weeks (OR 2.0; 95% CI: 1.3–3.0) compared to 1 – 5 weeks (Table 2).

Type of Birds

In total, 319 broiler with a mean age of 7.8 weeks (95% CI: 6.7 – 8.9), 77 cockerels mean age 15.0 weeks (95% CI: 11.2 – 18.8), 952 pullets, mean age 12.9 (95% CI: 12.7 – 13.3) and 602 layers, mean age 29.9 weeks (95% CI: 29.1 – 30.9) were included in this study. Layers showed a higher occurrence of MD 86.7%, followed by pullets with 62.1%. Compared to broilers, layers had the highest odds of infection with Marek’s disease (OR 31.3; 95% CI: 21.6–45.5, p < 0.0001) followed by pullets (OR 7.9; 95% CI: 5.7–10.8, p< 0.0001) and turkeys (OR 3.2; 95% CI: 0.9–11.7), (Table 3).

Table 2: Age distribution of Marek’s disease in poultry diagnosed between 2000 and 2009 in four states across Nigeria.

<table>
<thead>
<tr>
<th>Age group (in weeks)</th>
<th>MDP / TVD (Pr %)</th>
<th>Odds Ratio</th>
<th>95% C.I</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 – 4</td>
<td>35/238 (14.7)</td>
<td>1</td>
<td>RF</td>
<td></td>
</tr>
<tr>
<td>5 – 8</td>
<td>93/368 (25.3)</td>
<td>2</td>
<td>1.3 - 3.0</td>
<td>0.0021</td>
</tr>
<tr>
<td>9 – 18</td>
<td>490/686 (71.4)</td>
<td>14.5</td>
<td>9.8 – 21.5</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>&gt; 18</td>
<td>561/656 (85.5)</td>
<td>34.3</td>
<td>22.5 – 52.1</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>

Table 3: Distribution of Marek’s disease by types of bird diagnosed between 2000 and 2009 in four states across Nigeria.

<table>
<thead>
<tr>
<th>Type of Bird</th>
<th>MDx / TVDx (Pr %)</th>
<th>Odds Ratio</th>
<th>95% C.I</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Broiler</td>
<td>55/319 (17.2)</td>
<td>1</td>
<td>RF</td>
<td></td>
</tr>
<tr>
<td>Cockerel</td>
<td>18/77 (23.4)</td>
<td>1.5</td>
<td>0.8 – 2.7</td>
<td>0.2146</td>
</tr>
<tr>
<td>Pullet</td>
<td>591/952 (62.1)</td>
<td>7.9</td>
<td>5.7 - 10.8</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Turkey</td>
<td>4/10 (40.0)</td>
<td>3.2</td>
<td>0.9 - 11.7</td>
<td>0.079</td>
</tr>
<tr>
<td>Layer</td>
<td>522/602 (86.7)</td>
<td>31.3</td>
<td>21.6 – 45.5</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>
Season
Marek’s disease of 63.6% was recorded during the rainy season while 55.4% was recorded during the dry season. The chances of MD infection diagnosed was higher during the rainy season (OR 1.4; 95% CI: 1.2–1.7) compared to dry season (Table 4).

Table 4: Seasonal distribution of Marek’s disease diagnosed between 2000 and 2009 in four states across Nigeria.

<table>
<thead>
<tr>
<th>Season</th>
<th>MDx / TVDx (Pr %)</th>
<th>Odds Ratio</th>
<th>95% C.I</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rainy</td>
<td>787/1237 (63.6)</td>
<td>1.4</td>
<td>1.2 - 1.7</td>
<td>0.0003</td>
</tr>
<tr>
<td>Dry</td>
<td>406/733 (55.4)</td>
<td>1</td>
<td>RF</td>
<td></td>
</tr>
</tbody>
</table>

MDx – Marek’s Disease Diagnosed.
TVDx – Total Viral Diseases Diagnosed.
Pr – Prevalence of Marek’s Disease.
CI – Confidence Interval.
RF- Reference Group.

Region
The odds of having MD infection were significantly higher in the south (OR 7.8; 95% CI: 4.5 – 13.7 p < 0.00001) compared to the northern region of the country (Table 5).

Table 5: Regional and zonal distribution of Marek’s disease diagnosed between 2000 and 2009 in four states across Nigeria.

<table>
<thead>
<tr>
<th>Variable</th>
<th>MDx / TVDx (Pr %)</th>
<th>Odds Ratio</th>
<th>95% C.I</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Region</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>South</td>
<td>150/164 (91.5)</td>
<td>7.8</td>
<td>4.5 - 13.7</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>North</td>
<td>1043/1806 (57.8)</td>
<td>1</td>
<td>RF</td>
<td></td>
</tr>
<tr>
<td>Zone</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>North west</td>
<td>179/187 (95.7)</td>
<td>19.6</td>
<td>9.6 - 40.1</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>South east</td>
<td>21/34 (61.8)</td>
<td>1.4</td>
<td>0.7 - 2.9</td>
<td>0.33</td>
</tr>
<tr>
<td>South west</td>
<td>129/130 (99.2)</td>
<td>113</td>
<td>15.8 - 810.3</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>North central</td>
<td>863/1619 (53.3)</td>
<td>1</td>
<td>RF</td>
<td></td>
</tr>
</tbody>
</table>

MDx – Marek’s Disease Diagnosed.
TVDx – Total Viral Diseases Diagnosed.
Pr – Prevalence of Marek’s Disease.
CI – Confidence Interval.
RF- Reference Group.

Discussion
This result is the first current report on Marek’s disease with the highest prevalence of 60.6% investigated in four states which cut across the country. The lower peak differences within the years could be attributed to availability, adequate supply and use of MD vaccines thereby reducing disease outbreaks; poultry farmers increased awareness on MD, good management and biosecurity practices can also account for the low prevalence or the farmers were reluctant to report the outbreaks to the veterinary centres due to frustration by the disease. While the years which recorded higher outbreaks could be due to financial economic problems by small scale farmers to buy the vaccines since they come in high doses, lack of available MD vaccines and failure of chick sources...
or hatcheries to vaccinate at day old by dispatching the unvaccinated chicks to farmers to cut cost of production and maximize profit. It can be frustrating to vaccinate day old chicks that are due when the needed vaccines are yet to be cleared mostly from the ports since MD vaccines importation is the only source of getting the vaccines into the country. Also, poor management practices and emergence of more virulent MD virus strains which the vaccinal strains used could not protect the birds could be responsible for the increased outbreaks in those years as reported by OIE (2000) and Witter (2001).

The specific prevalence rate of MD in pullets and layers with mean age 12.9 and above 29.9 weeks old respectively could be due to late vaccine breaks while early MD outbreaks in chicks could be due to MD vaccine failure as reported by Witter and Schat (2003). The chances of having Marek’s disease was more in layers and Pullets this finding agreed with other findings that MD causes economic impact most during the onset of egg production or point of lay and in laying birds (Purchase, 1985; Owoade and Oni, 2008). In addition, our investigation showed fluctuation with noticeable peaks of MD infection mostly in pullets and layers to be more at risk as reported (Fatunmi and Adene, 1986; Olabode et al., 2009 and Wakawa et al., 2012).

The 40% prevalence of MD in turkeys in Nigeria was quite high and could be due to misdiagnosis of lymphoproliferative disease of turkeys as observed by Alaka et al., (1999) or, housing of turkeys side by side with chickens in contaminated environment which agreed with Okwor and Eze (2008). The seasonal distribution of MD indicated slightly higher occurrence in the rainy season (April-September) as reported could be due to mixed infections caused by wet litters which encouraged secondary infections, management stress such as poor ventilation with constant closure of windows thereby facilitating spread of MD (Witter et al., 1979 and Abbassi et al., 1999).

Records across geographical regions (Ekong et al., 2012) showed that the odds of having MD infection was significantly higher in the south (OR 1.8:95% CI with p<0.00001).This means that MD infection in the southern part of the country was two times more likely to occur than in the northern part. The establishment of more hatcheries, more commercial poultry farms, and commercial activities could account for more risks of having MD outbreaks in the southern region.

On zones, there were more hatcheries sited (within developmental areas) in the southwest which were exposed to high human activities and traffic movement could be one of the factors responsible for contamination and high MD outbreaks in this zone. In different zones, Fatunmi and Adene (1986) in Ibadan; Olabode et al., (2009) and Wakawa et al., (2012) reported similar study of MD from Ilorin and Zaria respectively.

The cause of increased MD outbreaks in Nigeria was observed as multifactorial and it was beyond the scope of this study to pin down one reason for the persistent endemicity of MD across the country. Despite the fact that the bulk of commercial poultry were adequately vaccinated as a means of protection from source of which the practices have not changed over the years, the disease remains a great challenge to the poultry industry. It could be speculated that the current wave in MD outbreaks in Nigeria might be due to Nigerian virulent strains or imported virulent strains of the virus since detailed information on vaccination procedures and biosecurity of the data were not collected which agreed with similar findings of Handberg et al., (2001) on the exact causes of MD in a flock.

Other prospective works like the use of PCR were carried out by the same authors to determine the presence of MDV antigen, Jwander et al., (2012) and the nationwide survey on the knowledge, attitudes, practices and diagnosis of MD among veterinarians in Nigeria (Jwander et al., 2012) further confirmed and supported the findings of this retrospective study.

Conclusions

The diagnosis of Marek’s disease obtained in four states across the country were mainly based on the clinical signs, gross lesions, and histopathological alterations indicating that MD
prevalence was high, has increased over the years and endemic in Nigeria.

**Recommendations to Stakeholders**

To poultry farmers, the best practice is good biosecurity contentment; raise birds of the same age at a time if not possible, keep two or maximum of three different ages with housing not too close to one another. Veterinarians should encourage farmers to administer potent MD polyvalent vaccines to all commercial and local chickens while broilers be administered mild MD vaccine. Government is to impose standards in poultry hatcheries, make MD vaccines available and more specific methods for diagnostic surveillance of MD and research to be encouraged in Nigeria.

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**References**


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