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A Retrospective Analysis of Infectious Bursal Disease Diagnosed at Poultry Unit of Ahmadu Bello University, Nigeria

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Abstract: A five year retrospective study (2004-2008) of the prevalence of Gumboro disease (infectious bursal disease, IBD) and other poultry disease diagnosed at the poultry unit of the Ahmadu Bello University Veterinary Teaching Hospital (ABUVTH), Zaria, Kaduna Nigeria was conducted. A prevalence of 7.26% (107 cases) was recorded out of 1473 cases of poultry disease. Gumboro disease occurred throughout the year in Zaria with a high incidence during the festival periods (July-September, October-December and January-March). The outbreaks of IBD were observed to be 1.3 times more likely to occur in pre-rainy season (April-June). Improved breeds of chickens were 5.8 times more likely to suffer from IBD than free range local chickens with broilers being 5.7 times more likely to suffer from the disease than other type of birds followed by layers kept together with cockerels. The prevalence of IBD is influenced by age of birds with an increase in the likelihood of IBD occurring within the age range of 3-5 week. Birds at 5 weeks old were at highest risk. Chickens with one vaccination history against IBD were 8.2 times more likely to suffer from the disease compared to non-vaccinated chickens. This study recommends that poultry farmers should be encourage to improve on farm biosecurity and ensure that their birds are vaccinated at least twice, before 3 and 5 weeks of age (at 1 and 3 or 2 and 4 weeks of age).

Key words: Infectious bursal disease, retrospective study, chicken, Nigeria

INTRODUCTION

Infectious Bursal Disease (IBD) also known as Gumboro is an acute, highly contagious viral disease of young chicken (Lukert and Saif, 1997). The causative agent is Infectious Bursal Disease Virus (IBDV) which belongs to the genus *Avibirnavirus* within the family *Birnaviridae* (Dobos *et al*., 1979). It is a non-enveloped icosahedral, bisegmented double stranded RNA virus with a diameter of about 55-60 nm (Ismail and Saif, 1990; Anonymous, 2009). The two serotypes, 1 and 2, of the virus are differentiated by Virus Neutralization (VN) test (McFerran *et al*., 1980). Serotype 1 contains the pathogenic strains to chicken and can be grouped into classical, antigenic variant and Very Virulent (vv) strains (Brown *et al*., 1994; Cereno, 2008).

When Infectious Bursal Disease (IBD) appeared in chickens in 1962, the disease was designated as "Gumboro disease" after the geographic location of the first recorded outbreaks (Muller *et al*., 2003). Since the first report, IBD has been reported in the poultry industries all over the world (Saif, 1998; Sharma *et al*., 2000). Ojo *et al*. (1973), first reported the disease in Nigeria. Subsequent studies have show that the disease has acquired endemic status among the Nigerian poultry populations (Nawathe *et al*., 1978; Durojaiye *et al*., 1984; Abdu, 1988).

IBD is an acute highly contagious viral infection of chicken between 3-6 weeks of age (Aiello, 1998). The disease by itself usually causes mortality of 5-10% but this rate can reach 30-40% (OIE, 2004). The outcome of IBD is largely dependant on the strain and the amount of the virus, age and breed of birds, the route of inoculation, the presence or absence of neutralizing antibodies, intercurrent primary and secondary pathogens and environmental and managemental factors (Muller *et al*., 2003).

The aim of this study was to review all the IBD outbreaks and other poultry diseases diagnosed at the Poultry Unit of the ABUVTH, Zaria and confirmed in the laboratory from 2004-2008. An association that exists between the prevalence of IBD and factors of host and environment for examples breed, poultry species, types of birds, vaccination history and season of the year would be determined.

MATERIALS AND METHODS

The five years records, January 2004 to December 2008 of the Poultry Unit of the ABUVTH, Zaria was subjected to a retrospective analysis. The date, age, address, flock size, morbidity rate, mortality rate, breed, species, type of birds, vaccination history and results on diagnosis of disease were extracted from the unit record books. Routine postmortem and microbiology or serology were carried out on the live or dead birds and samples obtained from them.

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Information on IBD cases were extracted from the record and the non-IBD cases were considered together as a group. A case was defined as a farm that reported an outbreak of a disease and diagnosed based on history, clinical signs, postmortem findings and laboratory results in ABUVTH, Zaria. Cases whose status are not known based on the factor under consideration are categorized as unknown.

The age of the birds were categorized in weeks but those between 0-2 weeks old were considered under one age group while those above 8 weeks were grouped into 9-11, 12-14 and above 14 weeks age group (Tong *et al*., 1993). The birds were categorized according to the purpose of keeping the birds, that is, breeders, layers, broilers, cockerels and mixed breeds', species, that is, chicken, turkey, ostrich, parrot, goose, and so on. Breed, that is local and improved (Halle *et al*., 1999).

The birds were categorized based on their sexual maturity, birds between the age range of 0-17 weeks were considered immatured birds while those 18 weeks and above were considered matured birds.

The seasons in Zaria and environs were categorized as follows: i) Dry season (January to march), ii) Pre-rainy season (April-June), iii) Rainy season (July- September), iv) Pre-dry season (October-December) (Sa'idu *et al*., 1994).

The data was reduced into tables with respect to frequency of IBD and other poultry diseases according to year, month, season, breed, specie, type, age and IBD vaccination history. The data was analyze using Statistical Package for Social Science (SPSS) version 17. Also the chi square was calculate using SPSS version 17, values of $p<0.05$ was also considered significant. The specific rates for each of the factor were also determine to establish whether or not an association existed between the factor and IBD. The odds ratio and 95% confidence interval on the odds ratio was also calculated for all variables in each factor to determine the significance of the association between the variables and IBD (Tong *et al*., 1993).

The seasonal variation was studied using the ratio to moving average to get the Isolated Monthly Index (ISMI) and Seasonal Index (SI) (Sa'idu *et al*., 1994).

RESULTS

A total of 1,473 cases of poultry disease were documented with 107 (7.26%) of the diseases diagnosed positive for IBD and this was significant with $p<0.05$. The year specific rate for IBD was highest in 2006 (9.1%) and lowest in 2007 (4.7%). However, only the odds ratio for 2004 (1.25), 2006 (1.34) and 2008 (1.18) were significant at 95% CI (Table 1). The SI was highest in 2006 and lowest in 2008.

The Month Specific Rate (MSR) for IBD was highest in May (13.5%) and lowest in January (2.8%) but only the odds ratio of May (2.23), June (1.15), July (1.08), August (1.23), November (1.46) and December (1.71) were significant at 95% CI (Table 2). This means that IBD was 2.23 times more likely to occur in May compared to all other months.

The ISMI and MSR of IBD showed a similar pattern with high rates from January-March, April-June, July-September and October-December and the highest peak in May.

The seasonal specific rate decreased from pre-rainy season to pre-dry season. However, only their odds ratios were significant at 95% CI (Table 3). This means that IBD was 1.0 time more likely to occur in pre-rainy, rainy and pre-dry season than in dry season.

The breed distribution of IBD cases when compared to other poultry diseases revealed that improved breeds were 5.8 times more likely to suffer from IBD compared to local birds. The breed specific rate was also higher in improved breeds (7.9%) of birds than in local birds (1.1%) (Table 4).

The poultry species specific rate for IBD showed that chicken had the highest rate (7.9%) compared to other species. Also, the odds ratio of chicken (11.9) was significant at 95% CI and this means that chicken were 11.9 times more likely to suffer from IBD compared to other species (Table 5).

The type specific rate for IBD showed that layers kept together with cockerels had the highest rate of 33.3% followed by broilers (23.2%) and the lowest rate was seen in layers (5.1%). However, only the odds ratio of layers and cockerels (2.67) and broilers (5.70) were significant at 95% CI. This means that IBD was 2.67 and 5.7 times more likely to occur in layers kept together with cockerels and broilers compared to other types of birds (Table 6).

The ages of 3, 4, 5, 7 and 8 weeks were significant at 95% CI for IBD with odds ratio of 5.44, 4.4, 9.99, 2.03 and 2.15 respectively. Age specific rates for IBD was highest in chicks 5 weeks old (38.5%) followed by chicks 3 weeks old (37.9%) and lowest in chicks above 14 weeks old (0%) (Table 7).

According to the history of IBD vaccination revealed that birds that received one vaccination were 8.2 times more likely to have IBD than those that received either none, one or two vaccination. The association was significant at 95% CI. The vaccination specific rate for IBD also showed that birds with one vaccination history had the highest rate (30.6%) and those with three vaccinations had the lowest rate (3%) (Table 8). The vaccination history for IBD revealed that 35.51% of farmers vaccinated their birds once, 56.2% vaccinated their birds twice and 0.93% vaccinated their birds thrice (Table 9). Table 10 shown that 59.3% of broilers and 40.7% of layers were vaccinated once against IBD while 54.5% of layers and cockerels and 6.1% of cockerels were vaccinated twice, only layers were vaccinated 3 times. The specific rate of vaccinated broilers was highest (24.4%) and vaccinated layers had the least specific rate (5.1%) (Table 11). Only the odds ratio of broilers (3.07)

Table 1: Yearly distribution of infectious bursal disease and other poultry diseases seen in Ahmadu Bello University Veterinary Teaching Hospital (2004-2008)

Years	IBD cases	Non-IBD cases	Year specific rate (%)	Seasonal index	OR	95% CI on OR
2004	21	223	8.60	93	1.252	0.761-2.060
2005	11	178	5.80	92	0.765	0.402-1.455
2006	17	169	9.10	124	1.338	0.777-2.302
2007	15	301	4.70	75	0.577	0.351-1.016
2008	43	495	8.00	57	1.182	0.791-1.767
Total	107	1366	7.26			

Table 2: Monthly distribution of infectious bursal disease and other poultry diseases seen in Ahmadu Bello University Veterinary Teaching Hospital (2004-2008)

Month	IBD cases	Non-IBD cases	Month specific rate (%)	OR	95% CI on OR
January	2	72	2.8	0.353	0.085-1.458
Febuary	5	71	6.6	0.894	0.353-2.264
March	3	97	3.0	0.377	0.118-1.211
April	5	132	3.6	0.458	0.183-1.145
*May	21	135	13.5	2.227	1.338-3.705
June	13	147	8.1	1.147	0.626-2.099
July	13	155	7.7	1.081	0.591-1.976
August	14	149	8.6	1.230	0.684-2.212
September	10	144	6.5	0.875	0.44-1.716
October	4	122	3.2	0.396	0.143-1.094
November	9	81	10.0	1.457	0.710-2.989
December	8	61	11.6	1.710	0.796-3.673
Total	107	1366	7.26		

*Significant at p<0.05

Table 3: Seasonal distribution of infectious bursal disease and other poultry diseases seen in Ahmadu Bello University Veterinary Teaching Hospital (2004-2008)

Seasonal	IBD cases	Non-IBD cases	Seasonal specific rate (%)	OR	95% CI on OR
*Dry (Jan-March)	10	240	4	0.484	0.249-0.941
Pre-rainy (Apr-June)	39	414	8.6	1.319	0.875-1.988
Rainy (Jul-Sept)	37	448	7.6	1.083	0.716-1.639
Pre-dry (Oct-Dec)	21	264	7.4	1.018	0.621-1.673
Total	107	1366	7.26		

*Significant at p<0.05

was significant at 95% CI and this means that vaccinated broilers were 3.07 times more likely to suffer from IBD compared to vaccinated cockerels and layers. The maturity specific rate for IBD showed that immature chickens had the highest rate (14.8%) compared to mature chicken. Also, the odds ratio of immature chicken (66.23) was significant at 95% CI and this means that immature chicken were 66.23 times more likely to suffer from IBD compared to matured chickens (Table 12).

DISCUSSION

The prevalence of IBD in this study was 7.26% which is lower than the 24.5% and 12.5% reported in Kaduna and Zaria by Salami *et al.* (1989) and Tong *et al.* (1993) respectively with 2006 having the highest specific rate and SI and 2007 having the lowest specific rate and SI. The low prevalence seen in the study may be attributed to that fact that more farmers are vaccinating their birds against IBD. The IBD low prevalence in 2007 may be attributed to outbreak of highly pathogenic avian influenza in 2006 which might have discouraged farmers from keeping birds (Adene *et al.*, 2006). The highest prevalence and SI recorded in 2006 may be attributed to the fact that a higher number of farmers reported any case of mortality due to outbreak of avian influenza in Kaduna that year (Adene *et al.*, 2006), hence encouraging the diagnosis of more cases of IBD. Gumboro occurred every year throughout the period of study with low specific rates suggesting that Zaria is an endemic area for IBD (Tong *et al.*, 1993).

Gumboro occurred mostly from April-September and November-December and the ISMI showed that the disease has four peaks; one from January-March another from April-June followed by July-September and one from October-December. This variation is associated to the fact that most farmers raised chickens, especially broilers for the Easter season (January-March), Sallah season (Id-el Fitri) (July-September), Christmas and New year season (October-December). As the residents in Zaria are predominantly Muslim (Net library, 2008), the sallah season probably accounts for a higher IBD peak from July-September compared to that of October-December and January-March. Also, poultry farmers apparently prefer to brood chicks during the pre-rainy and rainy (warm wet) season because during this period they experience low chick mortality

Table 4: Breed distribution of infectious bursal disease and other poultry diseases seen in Ahmadu Bello University Veterinary Teaching Hospital (2004-2008)

Breed	IBD cases	Non-IBD cases	Breed specific rate (%)	OR	95% CI on OR
*Improved	105	1231	7.9	5.758	1.405-23.589
*Local	1	92	1.1	0.131	0.018-0.947
Unknown	1	43	2.3	0.290	0.40-2.129
Total	107	1366	7.26		

*Significant at p<0.05

Table 5: Species distribution of infectious bursal disease and other poultry diseases seen in Ahmadu Bello University Veterinary Teaching Hospital (2004-2008)

Species	IBD cases	Non-IBD cases	Specie specific rate (%)	OR	95% CI on OR
*Chicken	106	1228	7.9	11.912	1.650-86.02
Turkey	0	56	0	-	-
Parrot	0	9	0	-	-
Pigeon	0	4	0	-	-
Emu	0	2	0	-	-
Peacock	0	1	0	-	-
Quail	0	2	0	-	-
Duck	0	6	0	-	-
Guinea fowl	0	1	0	-	-
Ostrich	0	3	0	-	-
Goose	0	8	0	-	-
Mixed species	0	2	0	-	-
Unknown	1	44	2.2	-	-
Total	107	1366	7.26		

*Significant at p<0.05

Table 6: Distribution of infectious bursal disease and other poultry diseases seen in Ahmadu Bello University Veterinary Teaching Hospital (2004-2008) based on type of bird

Type of bird	IBD cases	Non-IBD cases	Type specific rate (%)	OR	95% CI on OR
*Broilers	43	142	23.2	5.698	3.734-8.695
*Layers	50	939	5.1	0.391	0.263-0.581
Cockerels	5	55	8.3	0.722	0.285-1.831
Layers and Broilers	0	19	0	-	-
Layers and cockerels	3	9	33.3	2.673	0.716-9.914
Broilers and cockerels	0	5	0	-	-
Breeders	0	14	0	-	-
Local chickens	1	12	7.7	0.659	0.659-9.974
*Unknown	6	171	3.5	0.415	0.179-0.961
Total	107	1366	7.26		

*Significant at p<0.05

compared to what is obtained in the dry and pre-dry (harmattan) season from December-February (Tong *et al*., 1993). This probably accounts for the high peak of IBD cases seen from April-June and also lends support for the high frequency of IBD from pre-rainy to pre dry season. The lowest peak seen from January-March could be due to the fact that Easter is not keenly celebrated like Christmas and New year nationwide. Meulemans *et al*. (1980) reported the occurance of IBD with no apparent seasonality.

More IBD cases occurred in immatured improved chickens than local chickens because they are usually raised in a confinement and at times over crowded compared to the free ranging uncrowded local birds (Tong *et al*., 1993). The rapid growth rate in improved chickens may also be a factor that renders them more susceptible to the disease than local chickens (Tong *et al*., 1993). Also, the feeding habit of local chickens and differences in genetic lines in breeds of birds may also contribute to less susceptibility seen in local birds (Okoye *et al*., 1998). The very low level of outbreaks recorded in local birds could be due to poor reporting of IBD cases by the owner of such birds (Ambali, 1997). However, IBD has been reported in local chickens (Abdu, 1988; Okoye *et al*., 1998).

About 99% of all the cases of IBD were recorded in chickens. This observation lends the support to work by Saif (1998) and OIE (2004). They reported that clinical disease occurs solely in chicken although other species such as turkey, duck guinea fowl and ostriches may be infected (Saif, 1998; Oluwayelu *et al*., 2007).

Broilers and layers are the common types of birds kept in Zaria hence the high number of IBD cases (Tong *et al*., 1993). However, layers and cockerels had the highest specific rate and a high odds ratio because they are light breeds that are reported to be more susceptible to IBD than heavy breeds like breeders (Lukert and Saif,

Table 7: Age Distribution of infectious bursal disease and other poultry diseases seen in Ahmadu Bello University Veterinary Teaching Hospital (2004-2008)

Age	IBD cases	Non-IBD cases	Age specific rate (%)	OR	95% CI on OR
*0-2	2	102	1.9	0.145	0.035-0.594
*3	22	36	37.9	5.436	3.112-9.496
*4	21	42	33.3	4.396	2.532-7.630
*5	15	24	38.5	9.987	5.204-19.166
6	4	41	8.9	0.768	0.271-2.171
7	8	32	20	2.032	0.920-4.487
*8	11	42	20.8	2.153	1.086-4.269
9-11	9	98	8.4	0.712	0.353-1.438
*12-14	4	87	4.4	0.349	0.126-0.963
Above 14	0	772	0	0	-
*Unknown	2	78	2.5	0.193	0.047-7.93
Various age	0	12	0	0	-
Total	107	1366	7.26		

*Significant at p<0.05

Table 8: Distribution of infectious bursal disease and other poultry diseases seen in Ahmadu Bello University Veterinary Teaching Hospital (2004-2008) based on IBD vaccination

Number of IBD vaccination	IBD cases	Non-IBD cases	Specific rate (%)	OR	95% CI on OR
None	6	143	4.03	0.508	0.508-1.779
*One	38	86	30.6	8.197	5.215-12.883
*Two	60	961	5.9	0.538	0.361-0.813
Three	1	32	3.0	0.401	0.054-2.967
Unknown	2	144	1.4	0.114	0.074-0.759
Total	107	1366	7.26		

*Significant at p<0.05

Table 9: Vaccination history of infectious bursal disease and other poultry diseases seen in Ahmadu Bello University Veterinary Teaching Hospital (2004-2008)

Age at one vaccination (days)	Frequency	Age at two vaccination (days)	Frequency	Age at three vaccination (days)	Frequency
8	1	10 and 17	1	10, 18 and 32	1
		10 and 24	1		
		10 and 26	1		
		12 and 26	1		
14	27	7 and 14	3	-	-
21	4	10 and 21	3	-	-
19	2	11 and 22	3	-	-
28	1	14 and 21	3	-	-
35	1	7 and 21	6	-	-
49	2	14 and 28	33	-	-
Total (%)	38 (35.51)		60 (56.2)		1 (0.93)

1997; Okoye *et al*., 1998; Okoye and Uzoukwu, 2001). However, broilers had the highest odds ratio. This may be due to appreciable number of poultry farmers that do not revaccinate against IBD. Repeat vaccination of chicks against IBD at 4 and 6 weeks of age is practiced in some flocks to counteract declining levels of MDA (Saif and Swayne, 1998; Abdu, 1997).

Chicks at 0-2 weeks old possibly had a high level of MDA hence resistance to IBD. However, the MDA wanes within age (Abdu, 1997) and the bursa of Fabricius, the target organ reaches its maximum development between 3 and 6 weeks after hatch rendering the chicken highly susceptible to the IBDV (Muller *et al*., 2003). This probably accounts for the apparent susceptibility of the chicks from 3-5 weeks of age when the MDA is decreasing (Tong *et al*., 1993). Chicks between 7-14 weeks are also susceptible to IBD. This may be due to decline in immunity against the antigenic variant strains which is faster when compared to immunity to classical strains in pullets or the ability of the vvIBDV to break through the immunity provided by highly attenuated vaccine strain (Muller *et al*., 2003).

Birds with two IBD vaccinations had more outbreaks even though they were less likely to suffer from the disease. This is may be because of the ability of the vvIBDV to break through the immunity provided by highly attenuated vaccine strain (Muller *et al*., 2003), or the use of mildly attenuated vaccines in Nigeria where vvIBDV exist (Abdu, 1997; Zierenberg *et al*., 2000; Owoade *et al*., 2004). The vaccines available at present may not be effective because the recent epidemiology of IBDV has been marked by regular emergence of viral strains, which are able to develop in, vaccinated animals (Butcher and Miles, 2008). Some of these strains may

Table 10: Frequent age of vaccination against infectious bursal disease of infectious bursal disease cases seen in Ahmadu Bello University Veterinary Teaching Hospital (2004-2008)

No of IBD vaccination	Age at IBD vaccination	No vaccinated/ total vaccinated	% of birds	Type of bird	No vaccinated/ total vaccinated	% of birds
*One	14	27/38	71.5	*Broilers	16/27	59.3
				Layers	11/27	40.7
Two	14 and 28	33/60	55.0	*Broilers	7/33	21.2
				Layers	18/33	54.5
				Layers and cockerels	6/33	18.2
				Cockerels	2/33	6.1
Three	10, 18 and 32	1/1	100	Layers	1/1	100

*Significant at p<0.05

Table 11: Distribution of infectious bursal disease and other poultry diseases seen in Ahmadu Bello University Veterinary Teaching Hospital (2004-2008) based on type of bird vaccinated against IBD

Type of bird	IBD cases	Non-IBD cases	Specific rate (%)	OR	95% CI on OR
Cockerels	4	48	7.7	0.423	0.151-1.189
*Layers	49	910	5.1	0.212	0.136-0.329
*Broilers	39	121	24.4	3.072	2.023-4.665
Total	92	1079	7.26		

*Significant at p<0.05

Table 12: Distribution of infectious bursal disease and other poultry diseases seen in Ahmadu Bello University Veterinary Teaching Hospital (2004-2008) based on maturity

Maturity	IBD cases	Non IBD cases	Specific rate (%)	OR	95% CI on OR
*Immature	105	604	14.8	66.233	16.282-269.426
Mature	0	684	0	-	-
Unknown	2	78	2.5	2.5	0.76-1.298
Total	107	1366			

*Significant at p<0.05

be mutants that are not recognized by the antibodies generated by vaccination, thus reflecting antigenic drift of the virus (Delmas, 2006).

Outbreaks of IBD in vaccinated flocks have already been reported in Nigeria (Okoye, 1984, Abdu, 1986, Owoade *et al*., 2004). Birds with one vaccination history were more likely to suffer from the disease. This could be due to failure of the farmers to revaccinate their birds after the first vaccination which they undertake at 14 days. The time of vaccination is crucial as persisting MDA might neutralize the vaccine and the titre of antibodies induced by a vaccine vary considerably within the flock and revaccination may be necessary (Muller *et al*., 2003).

Conclusion and recommendations: Gumboro disease is endermic in Zaria and a disease of improved breeds of poultry with clinical disease seen only in chickens. Broilers and layers kept together with cockerels are mostly affected by IBD compared to other type of birds. The disease mostly affect immatured chicken of 3-5 weeks of age but those 7-8 weeks are also susceptible. The disease occurred through out the year in Zaria but is more prevalent during the festive periods of Easter, Sallah, Christmas and New year and pre-rainy and rainy seasons the preferable period for brooding chicks. Birds vaccinated twice are less susceptible to the disease.

It is recommended that farmer should improve on farm biosecurity and ensure that all young chickens are vaccinated from April to June each year. Also chicken should be stocked on farm by the type of bird only. Finally, broilers and layers should be vaccinated against IBD at least twice, one before 3 and another before 5 weeks of age (at 1 and 3 or 2 and 4 weeks of age).

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