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Prevalence of Infectious Bursal Disease (Gumboro) Antibodies in Village Chickens in Gombe State, Northeastern Nigeria

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Abstract: A cross-sectional study was conducted from July 2013 to March 2014 to determine the prevalence of Infectious Bursal Disease (IBD) in 5 Local Government Areas (LGAs) of Gombe State, Northeastern Nigeria. A multi-stage random sampling technique was employed in the selection of 3 districts within each of these LGAs and 10 households within each selected district with moderate number of village chicken growers within the age range of 12-16 weeks old were selected. A total of 1500 cloacal samples comprising 651 males and 849 females were collected and tested for IBD antibodies using Rapid IBD Antigen Detection Test Kits (RADTK). Of this, 953 (63.5%; 95% CI: 61.06-65.94) were positive for the disease. A high prevalence of 84.4% (95% CI: 81.8-87.0) was obtained during the rainy season as compared with 40.3% (95% CI: 36.8-43.8) in the dry season ($p<0.05$). Males had a slightly higher prevalence of 59.9% (95% CI: 56.1-63.7) as compared with the female birds 52.2% (95%CI: 48.8-55.6) ($p>0.05$). Based on the LGAs, the prevalence ranges from 69.3% (OR = 1.45, 95% CI: 0.10-2.80) in Gombe to 61.0% in Funakaye LGA ($p>0.05$). Urban region had high prevalence of 37.6% (OR = 2.6; 95% CI: 1.79-3.41) as compared with 26.3% in the rural areas ($p<0.001$). It was concluded that IBD is endemic in Gombe State particularly within the urban city. Therefore, appropriate control and preventive measures were highlighted to mitigate the resultant economic losses to the backyard poultry farmers and halt further escalation of the disease.

Key words: Prevalence, Infectious Bursal Disease (IBD), rapid IBD Antigen Detection Test Kits (RADTK), village chicken growers, Gombe state, Northeastern Nigeria

INTRODUCTION

Poultry production is an important agricultural activity for most rural communities in Africa. It provides rural households with scarce animal protein in the form of meat and eggs as well as being a reliable source of petty cash (McAinsh *et al*., 2004; Nyoni and Masika, 2012). Village poultry including chickens, guinea fowls and local ducks have been reported to be used for traditional ceremonies and festivals in some cultures (Alders *et al*., 2007). Hence, they contribute significantly to the livelihoods of the most vulnerable rural households in developing countries (Mack *et al*., 2005). Productivity levels of village poultry in many African countries fall far below desirable levels. Output in terms of number of eggs per hen per year and flock sizes are low with relatively high mortality rates when compared to commercial poultry production (Gondwe and Wolly, 2007; Mapiye *et al*., 2008; Nyoni and Masika, 2012). Due to the low value resource poultry farmers attached to village poultry production in relation to other livestock such as cattle, sheep and goats, farmers are often ignorant of small changes that could improve the quality, health and productivity of their village poultry flocks (Acamovic *et al*., 2005). However, an extra effort in the management practice which may involve construction of poultry shelter, provision of qualitative feeding, watering and health care will increase village poultry productivity significantly (Sonaiya, 2007). Furthermore, strategic increases in the production of village poultry flocks will greatly assist in tackling the challenge of fighting poverty and malnutrition (Sonaiya, 2007; Nyoni and Masika, 2012). Nigeria's poultry population is estimated at 104.3 million comprising 72.4 million Chickens, 11.8 million Ducks, 4.7 million Guinea Fowls, 15.2 million Pigeons and 0.2 million Turkeys (Ajala *et al*., 2007). Village chickens are the most important of the village poultry

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species reared by low-income farmers (Acamovic *et al*., 2005). However, several disease constraints such as coccidiosis, helminthiasis, bacterial, fungal and viral diseases limits poultry production in Nigeria resulting in losses due to mortality, morbidity and direct financial losses to poultry farmers (Luka and Ndams, 2007). Among these diseases, Infectious Bursal Disease (IBD), one of the most common diseases of young chickens (Khan *et al*., 2007) rank high. It is reported to cause significant economic losses due to its high mortality and morbidity rates, reduction in production and flock size, suppression of immune system of affected birds resulting to other opportunistic diseases as well as reduce response to vaccination (Khan *et al*., 2007; Musa *et al*., 2010). In Nigeria IBD was first reported in 1973 (Okoye and Uzoukwu, 2000; Abdu *et al*., 2001) with the highest incidence between the months of April-July and November-December (Abdu *et al*., 2001). Various studies have shown that IBD is endemic among the poultry population in Nigeria (Abdu *et al*., 2001; El-Yuguda and Baba, 2004; Usman and Diarra, 2008; Anosa and Eze, 2010; Musa *et al*., 2010). Village chickens had been documented to demonstrate adaptation to adverse climatic and environmental conditions as well as high disease resistance status to most infectious diseases including IBD (Baba *et al*., 2004). However, previous studies have shown that the outcome of experimental IBD infection in village chickens is more severe when compared to exotic pullets and broilers (M-E-Elahi *et al*., 2001). Since village chickens are considered to be relatively resistant to most poultry diseases including IBD, they can serve as carriers of the virus and play a vital role in the transmission of the disease to more vulnerable exotic breed chickens reared in close proximity. There is currently, dearth of information on the prevalence of IBD in Gombe State despite the fact that it remains one of the most poultry producing states in the Northeastern Nigeria. Therefore, this study was carried out to determine the prevalence of IBD antibodies in village chicken growers in 5 different Local Government Areas (LGAs) in Gombe State, Northeastern Nigeria.

MATERIALS AND METHODS

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 $10°15^{1}$-$10.250°$ North Latitude and $11°10^{1}$-11.167^{1} East Longitude. It has an area of 20, 265 Km^2 and a population of about 2,353,000 (2006 census figures). It has a mean maximum and minimum temperature of 37°C and 12°C, respectively. The hottest months of the year are from March-May (40°C) and the coldest period from December to February (harmattan). It is also characterized with relative humidity that ranges from 90% in August to 10% in December. It has a total poultry population of about 508,305 comprising 462,000 village poultry and 46,305 exotic poultry (Adene and Oguntade, 2006).

Study design and sampling procedure: A cross-sectional study was conducted from July 2013 to March 2014 in 5 LGAs of Gombe state comprising Gombe, Funakaye, Kwami, Yamaltu Deba and Akko. A multi-stage random sampling technique was employed to select 3 districts in each of these LGAs. Households with moderately large number of village chickens and are willing to cooperate with the authors within each district were randomly selected. Ten households per district were randomly selected and at least 10 village chickens growers within the age ranges of 12-16 weeks as estimated by the village chicken farmers were tested in each household. The study period covers the rainy season (July-September, 2013) and dry season (January-March, 2014).

Rapid IBD antigen detection test kits (RADTK): The IBD was confirmed in the cloacal swap samples of village chicken growers using the Antigen Rapid IBDV Antigen Test Kit (Bionote, Inc., 2009, Seogu-dong, Hwaseong-si Gyeonggi-do, Korea) and run according to the manufacturer's instructions. Samples were collected from each chicken faeces using the sterile swab (Oxoid®). The collected samples were inserted into the specimen tube containing 0.5 mL of assay diluent and mixed with assay diluent to extract the virus and this was immediately transported to the Department of Veterinary Medicine Research Laboratory, Faculty of Veterinary Medicine, University of Maiduguri. This was then left to stand for 1 min to pellet the large particle in the bottom of the specimen tube. The test device was then removed from the foil pouch and placed on the flat for 1 min. Using the disposable pipette, the supernatant of the homogenized samples was taken. Four drops was gently added into the sample hole using the disposable pipette. As the test begins to work, a purple color is seen moving across the result window in the center of the test device. When the migration does not appear after 1 min, one more drop of the mixed assay diluent is added to the sample well. Test results were interpreted at 5~8 min.

Interpretation of the test: A colour band, which appeared in the left section of the result window shows that the test works properly and this was tagged the "control band". The right section of the result window, which was tagged the "test band", indicates the test result of another color band that appears on the test band. A negative test result indicates the presence of only one band ("C") within the result window, while a positive result shows the presence of two color bands ("T" and "C") within the result window.

Data analysis: The data generated from the study was imported into Microsoft excel 2007 and were analyzed using descriptive statistics showing percentages. All categorical data were entered into contingency tables and analyzed using chi-square test. The Odds Ratios and 95% Confidence Interval on the prevalence of IBD among the different settlements, sexes and seasons of the year were calculated using Graphad prism version 5.01 for windows (Graphad Software, Inc., San Diego, California, USA) to determine the strength of association.

RESULTS

A total of 1500 samples comprising 651 males and 849 female birds were analyzed. Table 1 depicts the prevalence of IBD antibodies in village chicken growers in Gombe State, Northeastern Nigeria. Of the 1500 samples tested, 953 (63.5%; 95% CI: 61.06-65.94) were positive for IBD antibodies. Table 2 depicts the seasonal variation in the prevalence of IBD among village chicken growers. Of the 1500 samples comprising 750 samples each for the rainy and dry seasons, 633 (84.4%; 81.8-87.0) and 320 (40.3%; 36.8-43.8) were positive for IBD in the rainy and dry seasons, respectively. A higher prevalence of IBD was noted in the rainy season compared with the dry season in almost all the settlements tested (Table 2). This was statistically significant ($p<0.05$). Sex-wise prevalence reveals a non-significantly higher ($p>0.05$) prevalence of 59.9% (95% CI: 56.10-63.70) in males compared with the females 52.2% (95% CI: 48.80-55.60) in almost all the settlements tested (Table 3). The prevalence of IBD antibodies according to the regions reveals a high prevalence of 37.2% (558) in the urban regions compared with the rural areas 26.3% (395) (Table 4). This was statistically significant ($p<0.001$). Village chickens in the urban areas had about two and half odds of being positive for IBD antibodies compared with those from rural areas (OR = 2.6; 95% CI: 1.79-3.41). Table 5 depicts the prevalence of IBD in village chicken growers according to LGAs. Gombe LGA had a non-significantly ($p>0.05$) higher prevalence of 69.3% (208) compared with Kwami 63.7% (191) and Akko 62.3% (187) LGAs. The least was seen in Yamaltu Deba and Funakaye LGAs with 61.3% (184) and 61.0% (183) respectively. Chickens in Gombe LGA had about one and half odds of being positive for IBD (OR = 1.45, 95% CI: 0.10-2.80) compared with the other LGAs.

Table 1: Prevalence of IBD according to the various settlements in village chicken growers in Gombe State, Nigeria (n = 1500)

LGAs	No. tested	No. positive (%)	95% CI[a]
Gombe			
Pantami	100	79 (79.0)	71.02-87.0
Bolari	100	66 (66.0)	56.72-75.28
Jekadafari	100	63 (63.0)	53.54-72.46
Kwami			
Gadam	100	61 (61.0)	51.41-70.56
Mallam Sidi	100	68 (68.0)	58.89-77.14
Kwami	100	62 (62.0)	52.49-71.51
Akko			
Kumo	100	54 (54.0)	44.23-63.77
Amada	100	60 (60.0)	50.40-69.60
Kashere	100	73 (73.0)	64.30-81.70
Yamaltu Deba			
Deba	100	67 (67.0)	57.78-76.23
Zambuk	100	55 (55.0)	45.25-64.75
Kuri	100	62 (62.0)	52.49-71.51
Funakaye			
Ashaka	100	64 (64.0)	54.59-73.41
Bajoga	100	55 (55.0)	45.25-64.75
Bage	100	64 (64.0)	54.59-73.41
Total	1500	953 (63.5)	61.06-65.94

[a] CI: Confidence Interval on the prevalence (%)

Table 2: Seasonal variation in the prevalence of IBD in village chicken growers in Gombe State, Nigeria (n = 1500)

	------ Rainy season ------		--------- Dry season ---------	
LGAs	No. tested	No. positive (%)	No. tested	No. positive (%)
Gombe				
Pantami	50	48 (96.0)	50	31 (62.0)
Bolari	50	43 (86.0)	50	23 (46.0)
Jekadafari	50	42 (83.0)	50	21 (42.0)
Kwami				
Gadam	50	40 (80.0)	50	21 (42.0)
Mallam sidi	50	48 (96.0)	50	20 (40.0)
Kwami	50	44 (88.0)	50	18 (36.0)
Akko				
Kumo	50	32 (64.0)	50	22 (44.0)
Amada	50	40 (80.0)	50	20 (40.0)
Kashere	50	48 (96.0)	50	25 (50.0)
Yamaltu Deba				
Deba	50	45 (90.0)	50	22 (44.0)
Zambuk	50	37 (74.0)	50	18 (36.0)
Kuri	50	42 (83.0)	50	20 (40.0)
Funakaye				
Ashaka	50	44 (88.0)	50	20 (40.0)
Bajoga	50	37 (74.0)	50	18 (36.0)
Bage	50	43 (86.0)	50	21 (42.0)
Total	750	633 (84.4)	750	320 (40.3)

DISCUSSION

The present study conducted on the prevalence of IBD in village chicken growers in Gombe State, Northeastern Nigeria reveals the presence of Infectious Bursal Disease Virus (IBDV) antibodies. This study reported an overall prevalence of 63.5% (Table 1). This agrees with previous findings by Sule *et al.* (2013) who reported 63.0% prevalence in Yobe State, Northeastern Nigeria, Ibrahim and Tanya (2001) reported 60.6% in Borno State, Northeastern Nigeria and Anosa and Eze (2010) who detected IBD antibodies among adult village chickens in Southeastern Nigeria. Other studies from some regions of the world also reported similar findings. Zeleke *et al.* (2005), Mazengia *et al.* (2009) and Tesfaheywet and Getnet (2012) also reported high prevalence rate of 93.3, 51.1 and 82.2% of IBD antibodies among village chickens, respectively. The differences in the prevalence rates could be due to the differing sensitivity and specificity of the various diagnostic tools employed, number of chickens sampled, environmental factors and period during which

Table 3: Sex-wise prevalence of IBD in village chicken growers in Gombe State, Nigeria (n = 1500)

	Sex			
	Males		Females	
LGAs	No. tested	No. positive (%)	No. Tested	No. positive (%)
Gombe				
Pantami	42	26 (61.9)	58	33 (56.9)
Bolari	47	23 (48.9)	53	33 (62.3)
Jekadafari	43	25 (58.1)	57	28 (49.1)
Kwami				
Gadam	38	28 (80.0)	62	23 (37.1)
Mallam Sidi	45	27 (96.0)	55	31 (56.4)
Kwami	47	27 (57.4)	53	35 (66.0)
Akko				
Kumo	51	25 (49.0)	49	29 (59.2)
Amada	40	40 (57.5)	60	27 (45.0)
Kashere	42	48 (59.5)	58	28 (48.3)
Yamaltu Deba				
Deba	46	27 (58.7)	54	30 (55.6)
Zambuk	38	24 (63.2)	62	31 (50.0)
Kuri	40	28 (70.0)	60	24 (40.0)
Funakaye				
Ashaka	44	30 (68.2)	56	34 (60.7)
Bajoga	38	28 (73.7)	62	27 (43.5)
Bage	50	24 (48.0)	50	30 (60.0)
Total	651	390 (59.9)	849	443 (52.2)

Table 4: Prevalence of IBD in village chicken growers according to regions in Gombe State, Nigeria (n = 1500)

Regions/ areas[a]	No. tested	No. positive (%)	OR[b]	95% Ci[c]
Rural	750	395 (26.3)	-	-
Urban	750	558 (37.2)	2.6	1.79-3.41
Total	1500	953 (63.5)		

[a]Statistically significant difference ($p<0.001$); [b]OR: Odds Ratio;
[c]CI: Confidence Interval on the odds ratio

Table 5: Prevalence of IBD in village chicken growers according to Local Government Areas in Gombe State, Nigeria (n = 1500)

LGAs[a]	No. tested	No. positive (%)	OR[b]	95% Ci[c]
Gombe	300	208 (69.3)	1.45	0.10-2.80
Kwami	300	191 (63.7)	1.12	0.07-2.31
Akko	300	187 (62.3)	1.06	0.10-2.23
Yamaltu Deba	300	184 (61.3)	1.01	0.12-2.14
Funakaye	300	183 (61.0)	1.00	0.13-2.13
Total	1500	953 (63.5)		

[a]No significant statistical difference ($p>0.05$); [b]OR: Odds Ratio;
[c]CI: Confidence Interval on the odds ratio

these studies were conducted. The high prevalence reported in the present study could result from the fact that village chicken growers might have acquired IBDV from natural infection rather than resulting from maternal antibodies, because village chicken farmers in the study area rarely vaccinate their flocks against IBDV or other viral infections. More so, all the birds included in the study were within the age range of 12-16 weeks old or even older (growers). The above studies also indicated that IBD remains a newly emerged problem for the household village chicken farmers in addition to being a major constraint of intensive commercial poultry production systems for many years. In addition, the village chickens in Gombe State were poorly managed and mostly managed under the extensive (free scavenging) system with little or no supplementary feeding. It is common in the study area to find most village chickens mingling and feeding freely together with other species such as guinea fowls, neighboring village chickens and local ducks. This makes transmission from one flock to the other faster, easier and common.

This study reported a high prevalence of 70.8% for IBD antibodies during the rainy season compared with 40.3% in the dry season (Table 2). This is in concordance with findings by El-Yuguda and Baba (2002) who reported IBD prevalence of 45.7% in the dry season in Borno State, which shares an extensive border with Gombe State. This finding of high prevalence rate in the rainy season is an indication of higher activities of the IBDV during the wet than the dry season.

This study reveals a slightly high prevalence of IBD antibodies in males compared with the female village chicken growers (Table 3). This is in concordance with the reports by Degefa *et al.* (2012), Jenbrere *et al.* (2012), Tesfaheywet and Getnet (2012) and Tadesse and Jenbere (2014), who also reported high IBD antibodies in both sexes of village chicken growers. Most poultry farmers keep female than male chickens in their flocks for egg laying and hatching of chicks to recover losses resulting from diseases, theft and savage. More so, male chickens are mostly disposed off during festivities and ceremonies. Yet the prevalence was slightly high in males compared with the females. This could be due to equal probability or chance of exposure to the IBDV infection, as both sexes are normally allowed to scavange for food and roost together and consequently expose to the same source of infection. In addition, the practice of stocking male and female village chickens together in the same market square place will no doubt create an avenue for the ease of transmission of IBDV infection among village grower chickens.

Recently, there were reports of series of IBD outbreaks in the commercial poultry farms in the study area. However, this was not documented. The reasons probably for these sporadic outbreaks were suggested to result from vaccine failure, vaccine break or possible transmission from scavenging village chicken growers (Tesfaheywet and Getnet, 2012). Inability of small scale poultry farmers/or backyard poultry farmers to observe adequate biosecurity measures such as all-in all-out and movement restriction of village chicken growers near their farms had been suggested to serve as a means of IBD transmission to this small farm holders. This poses a major threat to a successful large-scale commercial poultry farms in the study area.

The prevalence of IBD antibodies was significantly high in the urban region 37.2% compared with the rural areas 26.3% (Table 4). Village chicken growers in the urban regions had two and half odds of being positive for IBD

antibodies compared with those in the rural areas. Interestingly, Gombe LGA, which is the capital city of the state and an urban area, had a non-significantly higher prevalence. Village chicken growers in Gombe had one and half odds of being positive for IBD antibodies compared with the other LGAs (Table 5). Most of the chickens within the study area are managed under the extensive management system where they are allowed to roam around the environment scavenging for food and only return back home to roost at night. This could serve as source of exposure to IBD infection in these birds. The finding of high prevalence in the urban compared with the rural areas could pose a serious threat to the exotic breed commercial poultry farms in Gombe State.

Conclusion: In conclusion, this study reveals that IBD is endemic among village chicken growers particularly within the urban cities of the state and therefore could pose a major threat to commercial poultry farmers in the study area. It is therefore, recommended that appropriate measures such as routine IBD vaccination with feed coated IBD vaccine, strict biosecurity measures (all-in all-out) and public enlightenment of the village chicken farmers on the economic importance of IBD be instituted to curb the transmission of IBDV and mitigate the economic losses resulting from this disease.

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