P-ISSN: 2304-3075; E-ISSN: 2305-4360
International Journal of Veterinary Science
www.ijvets.com; editor@ijvets.com

Research Article

Occurrence of Antibodies to Infectious Bursal Disease Virus in Non-Vaccinated Indigenous Chicken, Ducks and Turkeys in Kenya

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Article History: Received: June 25, 2017 Revised: July 16, 2017 Accepted: August 01, 2017

ABSTRACT

Infectious bursal disease (IBD) is ranked as the second most important disease of indigenous chicken, responsible for marked economic losses in Kenya after Newcastle disease. However, infected turkeys and ducks do not show overt IBD clinical signs and they may act as a source of IBD infection to naive chicken kept in such mixed flocks. Such evaluation has not been undertaken in mixed free range birds. A cross-sectional study was therefore undertaken to determine whether non-vaccinated indigenous village chicken, ducks and turkeys in Embu County, Kenya were naturally exposed to IBD virus (IBDV). A total of 97 free range indigenous chickens, 32 ducks and 13 turkeys blood samples were collected for serum. Indirect Enzyme Linked Immunosorbent Assay (ELISA) technique was used to detect the IBDV antibodies. The result showed IBDV Sero-positivity in 64.9% of the chicken, 6.25% of ducks and 92.3% of turkeys. The presence of IBDV antibodies in non-vaccinated free range indigenous village chicken and healthy ducks and turkeys suggests an ongoing IBD virus circulation and maintenance in the area. There is therefore, a need for routine surveillance and vaccination against IBDV in indigenous village chicken, ducks and turkeys to prevent spread of the disease. More research is needed to find out the role of turkeys in the spread of IBDV.

Key words: Infectious bursal disease, Indirect enzyme-linked immunosorbent assay, Sero- prevalence

INTRODUCTION

In developing countries, nearly all families at the village level own free range indigenous poultry since they are easy to manage, require little space and relatively low initial capital (Nduthu, 2015). Indigenous chicken raised in rural settings under free range systems are routinely exposed to overwhelming numbers of microorganisms, some of which are highly infectious such as infectious bursal disease virus (Olwande, 2014). Infectious bursal disease is an acute, highly contagious viral disease of young birds characterised mainly by severe lesions in bursa of Fabricius causing fatal condition and immunosuppression in chickens (Tadesse and Jenbere, 2014). This disease is reported globally as being of economic importance and has been linked to 100% morbidity and mortality rates in indigenous chicken (Mutinda *et al.*, 2013; Mutinda, 2016). The high morbidity and mortality of the diseased chicken, lead to losses which affects the economy of the poor, especially, women and youth who largely own these birds (Guèye, 2009).

Chicken are the only birds known to develop clinical disease and distinct lesions when exposed to IBDV (AU-IBAR, 2013). However, IBDV antibodies have been observed in eider ducks and indigenous Nigerian ducks (Hollmen *et al.*, 2000; Oluwayelu *et al.*, 2007) and in experimental studies in United Kingdom and Taiwan (Eddy, 1990; Tsai *et al.*, 1996). In addition, antibodies have been demonstrated in farmed commercial turkeys in Canada (Reddy and Silim, 1991) and experimentally infected turkeys with the IBDV (Giambrone *et al.*, 1978; Weisman and Hitchner, 1978). Wild birds and several rare avian species including ostriches, Antarctic penguins, gulls, crows and falcons have been found to have antibodies against the virus (AU-IBAR, 2013). Presence of IBD antibodies in these birds indicates that they may be involved in the maintenance of IBDV and its resultant transmission to chicken. Sule *et al.*, (2013) and Olwande (2014) recommended routine surveillance for IBDV antibodies and investigations of risk factors involved in the maintenance of IBDV in free range indigenous chicken as this would help in the development of

Cite This Article as: Wahome MW, LW Njagi, PN Nyaga, PG Mbuthia, LC Bebora and MO Bwana, 2017. Occurrence of antibodies to infectious bursal disease virus in non-vaccinated indigenous chicken, ducks and turkeys in Kenya. Inter J Vet Sci, 6(3): 159-162. www.ijvets.com

acceptable control program(s). However, no such studies have been carried out in Kenyan in mixed free range poultry, namely: chicken, ducks and turkeys, in none vaccinated flocks. This study was therefore done to determine the role of ducks and turkeys as a possible source of infection in the natural epidemiology of infectious bursal disease virus in indigenous chicken in Kenya.

MATERIALS AND METHODS

Study site: The study was conducted in Embu County, Kenya. The area has a high population of indigenous village poultry, approximately 202,410 (KNBS, 2009); and rearing of chicken is a major source of livelihood. The site was purposively selected based on the large population of free range poultry and previous studies which have unravelled several challenges in poultry production in the area (Njagi *et al*., 2010; Kemboi *et al*., 2013).

Study design and sampling: This was across sectional study undertaken in Embu County, Mutuobare sub-county in households with indigenous chicken, ducks and turkeys from December 2016 to April 2017. A total of 142 small holder indigenous village birds comprising (97) chicken, (32) ducks and (13) turkeys were sampled from smallholder farms based on owners being reachable, kept the birds on free range system, mixed flocks and that they had no history of IBD vaccination. The sample comprised birds of all age groups and of both sexes.

Animal welfare

Permission to use chickens, ducks and turkeys in the experiment was granted by the Biosecurity, Animal use and ethics Committee of the faculty of Veterinary Medicine, University of Nairobi. The birds were handled according to the internationally accepted regulations and ethical consideration in animal experiments.

Blood collection and processing

Chicken, ducks and turkeys were bled. Collected blood was put into labelled sterile universal bottles, without anticoagulant. The universal bottles were placed in a rack slanted for clot to form, later incubated at 37^{o}C for 2 hours, refrigerated overnight at 4^{o}C and finally centrifuged at 3000 revolutions for 10 minutes. Separated serum was harvested and transferred to sterile labelled bijou bottles and stored at -20^{o} C until tested.

Enzyme Linked Immunosorbent Assay (ELISA)

Indirect Enzyme Linked Immunosorbent Assay using IDEXX IBD-XR ELISA kit from IDEXX Laboratories, Inc. Westbrook, Maine 04092 USA, was performed on all serum samples collected as described by the manufacturer (IDEXX IBD-XR Ab Tests technical guide).

The relative level of antibody in the sample was determined by calculating the sample to positive (S/P) ratio (OIE, 2016) as shown below:

$$\frac{s}{p}ratios = \frac{sample\ mean - Negative\ control\ mean}{Positive\ control\ mean - Negative\ control\ mean}$$

Serum samples with S/P ratios of less than or equal to 0.20 were considered negative. Sample to positive ratios greater than 0.20 were considered positive and indicated vaccination or exposure to IBD virus according to the manufacturers' instructions (IDEXX IBD-XR Ab Test Kit technical guide)

Data analysis

Data were entered in Microsoft Excel and analysed in R version 3.3.1. The prevalence of antibodies to Infectious bursal disease virus was calculated using the formula outlined by (Bennette *et al*., 1991):

Prevalence (%) = number of serum positive/total number of serum examined × 100

RESULTS

Sero prevalence of chicken, ducks and turkeys to Infectious bursal disease

Enzyme Linked Immunosorbent Assay results indicated that 64.9% (63/97), 6.25% (2/32) and 92.3% (12/13) of serum samples were positive for infectious bursal disease in free range indigenous chicken, ducks and turkeys, respectively (**Table 1)**.

Sero prevalence in different age groups of indigenous village chicken, ducks and turkeys

When indigenous village chicken was considered with respect to age, sero prevalence rate of IBDV were 51.16% (22/43), 69.70% (23/33) and 85.71% (18/21) in chicks, growers and adults respectively. In ducks sero prevalence rates were 0% (0/3), 7.14% (1/14) and 6.67% (1/15) in the duckling, growers and adults respectively. For turkeys 0%, 50% (1/2) and 90.9% (10/11) sero prevalence was found in poults, growers and adults respectively (Table 2).

NB: Chicks, duckling and poults were less than 2 months old; growers were between 2 to 8 months; and adults, above 8 months of age (Kemboi, 2013).

Table 1: Prevalence of infectious bursal disease virus in free range indigenous chicken, ducks and turkeys

Species	Number tested	Number positive	Percentage positive (%)
Chicken	97	63	64.9
Ducks	32	2	6.25
Turkeys	13	12	92.3
Total	142	77	54.2

Table 2: Prevalence in different age groups of indigenous village chicken, ducks and turkeys

Variable	Number examined	Positive number examined
	Chicken age groups	
Chick	43	22/43 (51.2%)
Grower	33	23/33 (69.7%)
Adult	21	18/21 (85.7%)
	Ducks age groups	
Duckling	3	0/3 (0%)
Grower	14	1/14 (7.14%)
Adult	15	1/15 (6.67%)
	Turkeys age groups	
Poult	0	0%
Grower	2	1/2 (50%)
Adult	11	10/11 (90.9%)

DISCUSSION

Free range indigenous chickens are rarely vaccinated against infectious bursal disease (Mushi *et al*., 1999; Oni *et al.,* 2008; Mutinda, 2016). The detection of IBDV antibodies in all ages groups of birds in this study indicates natural exposure to infection of the adult birds or evidence of maternal antibodies to the young birds since antibodies have been reported to persist in unvaccinated chicks up to 21 days and disappear by 28 or 35 days post infection (Fahey *et al*., 1991; Yannick, 2015). The sero prevalence (64.9%) found in this study was similar to other studies conducted in non-vaccinated indigenous village chicken (Sule *et al.,* 2013; Lawal *et al.,* 2014). However, the findings were lower compared to those reported by Oni *et al.,* (2008) of 89.7% in Nigeria. In addition, other authors have similarly reported higher values: Degefu *et al.,* (2010) 76.6% in Western Ethiopia; Kassa and Mola, (2012) 75% in Northern Ethiopia; Zeryehun and Fekadu, (2012) 82% in Central Oromia; and Tadesse and Jenbere, (2014) 83% in Eastern Ethiopia. However lower levels have been reported by Mushi *et al*., (1999) 30% in Gaborone, Botswana; Mahasin and Rahaman, (1988) 30.7% in Sudan; and Swai *et al*., (2011) of 58.8% in Northern Tanzania. The level is close to those reported by Sule *et al*., (2013) of 63% in Yobe State Nigeria and Lawal *et al*., (2014) of 63.5% in Gombe State, North Eastern Nigeria.

Some husbandly practices may favour the spread and maintenance of this economically important infectious disease (Sule *et al.,* 2013), including: inappropriate sanitary conditions, nutritional deficiencies, continuous exposure to wild birds, absence of routine vaccination, rearing of different species of birds together, and mixing of chicken during transit and at points-of-sale in markets (Swai *et al.,* 2011). Many of these factors were observed in the study area, for example: chicken freely scavenging and mixing with other species like ducks, turkey and the chicken from the neighbours while searching for feed; and returning birds from the markets. These activities readily facilitated the transmission of IBDV in village chicken. The IBD virus can survive for long in the environment thus enhancing its transmissibility (Mutinda *et al*., 2014).

Oladele *et al*., (2008) using immunohistochemistry found that turkeys and ducks are susceptible to IBD virus, but normally do not manifest clinical disease. Out of the 32 ducks sampled in the current study, only 2 (6.25%) were sero-positive which was significantly lower compared to the findings of Hollomen *et al.,* (2000) who detected 75% prevalence in the sera of Eider ducks in Finland; and Oluwayelu *et al.,* (2007) who reported prevalence of 19.1% (24/126) in indigenous Nigerian ducks. Geetha *et al.,* (2008), on the other hand, found a lower prevalence of 1.09% in domestic ducks in Asia. Infectious bursal disease virus has been isolated from the faeces of healthy ducks and from bursae of 5-16 day old duckling by McFerran *et al.,* (1980) and Karunakaran *et al.,* (1992) in India, respectively. Weisman and Hitchner, (1978) experimentally infected turkeys with IBDV and later found that the birds developed antibodies against IBDV. Almost all (12/13; 92.3%) the turkeys tested in our study were sero-positive suggesting a markedly significant exposure of IBDV and a highly possible source of the infection to chicken in mixed flocks. Infection in turkeys has been reported in Iowa USA and United Kingdom (Barnes *et al.,* 1982; Weisman and Hitchner, 1978). Turkeys may therefore be better carriers of the virus than ducks.

Highest prevalence rate was recorded in adults (chicken, 85.71% and turkeys, 90.9%). This finding was same as Zegeye *et al.,* (2015) finding of highest IBDV prevalence in >12 months old (64.57%) and contrary to finding reported by saif *et al.,* (2000) showing higher prevalence of IBD in chicken aged below 12 weeks.

In an African rural setting like Embu, ducks and turkeys are mostly raised together with chicken under a free range system. The detection of IBDV antibodies in non vaccinated ducks and turkeys indicates that these birds were exposed to the virus at some point of their life suggesting that these birds are possible asymptomatic carriers and they could play an important role in the natural maintenance and spread of IBDV. They could be a significant source of infection to the free range indigenous as well as the commercial exotic chicken. It is not clear why turkeys showed such high levels and prevalence of antibodies compared to the ducks and this may require further investigation to better understand the epidemiology of IBDV in indigenous chicken.

Conclusion

Presence of IBDV antibodies in indigenous village chicken, ducks and turkeys indicates high IBD virus activity in Embu County, Kenya. These findings therefore imply a need for routine surveillance and vaccination against IBD in indigenous village chicken, ducks and turkeys.

Acknowledgements

The corresponding author thanks the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM) for the academic scholarship offered that enable this study. The authors appreciate the poultry farmers and local guides of Embu County for their assistance and cooperation during the field study. Thanks to Mr. Patrick Wahome, Ms. Mary Mutune and Ms. Peninnah Ateku for technical assistance during field and laboratory sample analysis.

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