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Infectious Bursal Disease (Gumboro) in Backyard Chicken in Jordan

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ABSTRACT

Infectious bursal disease (IBD) is an acute and highly infectious and contagious disease that affects young chickens. The current study aims to determine the seroprevalence of IBD in healthy, non-vaccinated male chickens raised as backyard chickens and histopathological changes. We collected 210 tissues and blood samples from backyard chickens in Amman, Jordan. Indirect ELISA was applied to test serum samples for IBD virus antibodies. Morbid tissue samples of livers and spleens were processed for histopathological examination. The study revealed 80.95% prevalence rates of infectious bursal disease virus (IBDV) antibodies. Seropositivity to IBDV did not vary significantly between the study sites. It was concluded that IBD is endemic and broadly appeared in the studied areas. Histopathological study revealed that IBD rendered depletion of lymphoid tissue in the spleen. The franked disease did not occur in adult and older chickens, though those were also seropositive for IBD virus antibodies.

Key words: Infectious Bursal Disease, Backyard Chickens, ELISA, Antibody, Histopathology

INTRODUCTION

Infectious bursal disease (IBD) affects young chicks and suppresses immunity, and this disease is rendering significant economic losses in the poultry industry globally (Wagari 2021; Amajo et al. 2022). The disease affects lymphatic tissues like the bursa of Fabricius, spleen, etc., and results in lymphoid depletion in the bursa of Fabricius (Getachew and Fesseha 2020; Amajo et al. 2022). The virus belongs to the Birnaviridae family (Mahmoud et al. 2019; Waheed et al. 2022). Cosgrove (1962) reported a specific disease (IBD) that affects the bursa of Fabricius in chickens. The first case was reported in Gumboro in Delaware, the United States of America, from which the name was taken (Wagari 2021). The broiler disease is characterized by immunosuppression, mortality, and decreased feed conversion ratio (Parker and Wit 2014; Dey et al. 2019; Okino et al. 2020; Mili et al. 2022).

Clinical signs of this disease depend on different factors such as the age of the birds infected, chicken type, strain of the virus, maternally derived antibodies and vaccination history. Disease signs vary from subclinical to clinical, and poor feed conversion, diarrhea, and mortality (De Wit et al. 2001). Infectious bursal disease control is one of the most challenging tasks in poultry management; it depends on appropriate vaccination programs and maintenance of good hygiene on the farm (Farooq et al. 2003; Kundu et al. 2017).

Commercial enzyme-linked immunosorbent assays are available to detect antibodies against IBD antibodies. These kits provide reliable results (De Wit et al. 2001; Parker and Wit 2014; Zachar et al. 2016; Mahmoud et al. 2019). In the current study, the presence of antibodies in the blood of male backyard chickens is screened using ELISA techniques.

MATERIALS AND METHODS

The experimental protocols were approved by the institutional review board at the University of Jordan, decision. Animals were reared and treated per the EU Directions 2010/63/EU.

This study was conducted from June 2021 to September 2021, the hot months of the year in Amman, Jordan. Three areas around the city, namely, Wadi Al sir, Alwehdat, and AlBaqa, were selected. A cross-sectional study was planned to know the prevalence of IBD. A total of 210 blood samples were collected, keeping the expected majority at 50% and an absolute precision of 5% with a 95% confidence level (Thrusfield 1995).

Healthy male chickens from backyard poultry were randomly selected from each area. The chickens were grouped into three according to age (G-1: <6 months, G-2:

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6 months to one year, and G-3: above one year). Birds were not vaccinated against IBDV. About 2.5mL of blood without anticoagulant was collected from each bird from the wing vein. The serum was extracted by centrifuging blood samples in the Jordan University Animal Health Laboratory.

The ELISA kit used for the detection of IBDV was bought from Shenzhen Lvshiyuan Biotechnology Co, Ltd, Shenzhen, China. Indirect enzymatic immunoassay (Indirect ELISA) is the base of the ELISA kit. While testing, we added the diluted serum sample (1:100) after incubation at 37°C for 30min. Serum samples with specific antibodies against IBDV will bind to the antigen coated on plates. We washed the ELISA plate, then added a specific enzyme conjugate. After incubation at 37°C for 30min and washing, we discarded the unbound conjugate, added the TMB substrate, and at the appearance of colorimetric reaction, we added stop solution; OD was measured at 450nm using a spectrophotometer (Bio Tek ELX800, Cole-Parmer, Germany).

We also collected liver and spleen tissue samples from the morbid chickens. Tissues were preserved in 10% buffered formalin. These tissues were processed in ascending grades of alcohol and cleared in xylene, and embedded in paraffin for histopathological studies.

We prepared a data spreadsheet and used the SPSS analysis program version 20 for data analysis. The chi-square test was applied to know the association between the risk factors (origin and age) and disease at 95% confidence intervals and $P<0.05$.

RESULTS AND DISCUSSION

The seropositivity of IBD antibodies was found to be 80.95% (170/210) in backyard chickens. The seroprevalence of IBD was higher in group 1 (85.71%) followed by group 3 and group 2 (Table 1). However, there was a non-significant difference ($P=0.848$).

In the present study, the seroprevalence of IBD was 80.95% and variable among age groups. Although we think of IBD as a disease of young birds, the IBD virus can also infect older pullets (Jackwood 2021). The various age of pullets has been recorded for the detection of very virulent (vv)IBD virus outbreaks in the US (9-week-old pullets). At the same time, in Europe there are reports of vvIBD virus infecting pullets as old as 15 to 18 weeks of age (Jackwood 2021). IBD strikes young chickens at 3–6 weeks of age, while sub-clinical infection is established in older birds (Dey et al. 2019). According to Wakgari (2022), Chickens with age (< 17 weeks are young, while those≥ 17 weeks old are adults for the clinical manifestation of IBD disease.

Table 1: Seroprevalence of IBDV in chickens detected by indirect ELISA

Groups	Age (months)	Total Birds	Positivity	
			No.	%
1	<6	70	60	85.71
2	6–12	80	60	75.00
3	>12	60	50	83.33
	Total	210	170	80.95

Data analysis by Chi-square (Chi-square value=0.329; df=2; P value=0.848).

As we collected samples from unvaccinated chickens, and seroprevalence of IBD was high. Similarly, Daodu et al. (2018) reported 100% IBDV antibody in Egypt's unvaccinated birds/morbid birds. Mutinda et al. (2015) reported that IBD mortality rates from 1.3-100% in flocks of Kenya indigenous chickens with an average mortality of 39.2%, high (31.1%) in layers, and 13.4% in broilers. From India (Singh and Dhawedkar 1994), Taiwan (Tsai and Lu 1993), and Ethiopia (Wakgari 2022), seroprevalence of IBDV has been reported to be 46.2, 45 and 43.13%, respectively.

According to Zegeye et al. (2015), the seroprevalence of IBDV was higher in chickens more than above one year (64.67%), followed by in 6-12 months (55.24%) and less than six months old chickens (21.71%).

According to Jackwood (2021), IBD in older birds usually does not cause permanent immune system suppression, but the disease can last a week or more, compromising the pullet's immune system. He further stressed that birds are vulnerable to infections by opportunistic microorganisms that can exacerbate morbidity and mortality and increase the cost of producing a high-quality layer flock.

According to Dey et al. (2019), clinical manifestation of IBD is dependent on various factors like age, strain of the virus, maternal antibody titer, type of vaccine used, breed of the bird, etc. The incubation period is 2–3 days, after which the infected birds show distress, depression, ruffled feathers, anorexia, diarrhea, and soiled vent; classical strains of the virus can cause 10–50% mortality rates in infected flocks, whereas vvIBDV strains can cause 50–100% mortality (Dey et al. 2019).

Seroprevalence of IBD could be affected by different factors like the level of education of the poultry farmer, the size of the flock, and better biosecurity measures (disinfection of the house, isolation practices). A lower prevalence of the disease (Bedasa et al. 2022) was reported in the good hygienic house (28.7%) than in less hygienic houses (96.4%) with a significant difference ($P<0.05$). Poor farm hygiene, biosecurity, age of the flock, insufficient vaccine coverage, production type (closed or open houses), floor type, flock size, farmers' education, and know-how are directly linked with commonly occurring poultry diseases (Carrique-Mas et al., 2019; Islam et al. 2021). Abdeta et al. (2022) also used indirect ELISA to detect the seroprevalence of IBD in backyard poultry in Ethiopia. They found 66.93% positive samples. Islam et al. (2021) further reported that the prevalence of IBD exhibited a significant ($P<0.05$) correlation among chicken rearing practices, breed and origin, and owner education level. According to them, most poultry farmers lacked knowledge about poultry diseases, particularly IBD.

Results of Wahome et al. (2017) showed high IBDV seropositivity as they recorded 64.9, 6.25, and 92.3% in chickens, ducks, and turkeys, respectively. The presence of IBDV antibodies in the blood of non-vaccinated indigenous village birds is a sign of IBD virus circulation. Also, Abraham et al. (2015) mentioned that the seropositivity of IBD infection was 51.6%, which means that the disease is endemic; the current study was done in the hot season. According to Lawal et al. (2014), a higher prevalence of 84.4% was obtained during the rainy season

compared to 40.3% in the hot season. The high prevalence in the rainy season could be due to the virus finding a suitable environment to proliferate, while males had a higher prevalence of 59.9% compared to female birds (Lawal et al. 2014).

In the present study, post-mortem examination displayed hemorrhages in the thigh muscle, bursa, and spleen. The spleen was enlarged and mottled. Vegad and Katiyar (2018) stated that in the case of IBD, hemorrhages of leg muscles are typical lesions. We noted necrosis and congestion in the liver. There was also the presence of portal inflammatory infiltrates, ductal necrosis, inflammation with lymphocytes, plasma cells, and neutrophils or polymorphonuclear eosinophils (Fig. 1). Similar results were reported by Rocío del Pilar López Panqueva (2016) and Hanaa (2020).

The bursa was enlarged, severely congested, and swollen in the present study. The lesions observed in the spleen were almost similar to the findings of Dutta et al. (2007). We observed histopathologically focal eosinophilic necrotic areas in the bursal follicle and depletion of lymphocytes in the spleen. These lesions were following the observations of Samanta et al. (2008), Bhutia et al. (2017), and Pathak et al. (2022).

We also observed that IBDV induces injury in the spleen, and, in subclinical cases, mild congestion and thickened wall of blood vessels with perivascular edema, along with lymphocytic infiltration; Hanaa (2020) also reported similar results. Severe cell necrosis was noticed in the spleen of infected birds (Fig. 1, 2). Macro and microscopic damage to the spleen by IBDV has been reported by Scanavini Neto et al. (2004). Orakpoghenor et al. (2021) also noted that the spleen was affected and enlarged after infection by the infectious bursal disease virus.

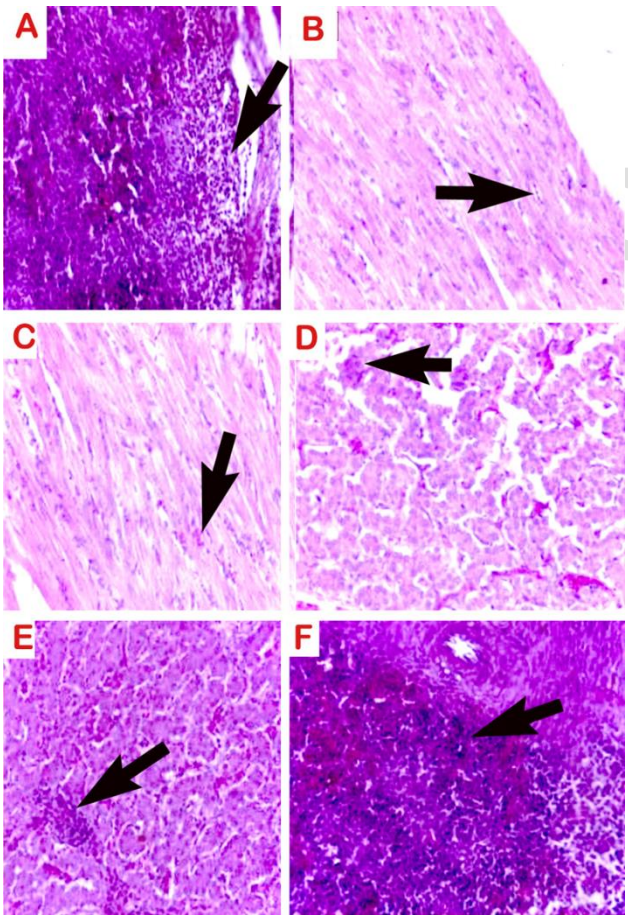

Fig. 1: Histopathological lesions of IBD in young chickens. Necrosis and congestion in the liver (A), presence of portal inflammatory infiltrates (E, F), ductal necrosis (D), inflammation with lymphocytes, plasma cells, and neutrophils or polymorphonuclear eosinophils (B, C, D). H and E; Lens: 40X.

Conclusion

IBD is a significant factor impeding the health and production of backyard poultry birds. Its prevalence in the study areas was found to be 80.95%. The prevalence of IBD among various age groups of chickens did not vary. Histopathological study revealed that IBD rendered depletion of lymphoid tissue in the spleen. In the published literature, so many risk factors associated with the occurrence of IBD have been reported. There is a dire need to explore all possible risk factors to curtail IBD in the country so that possible strategies be developed to prevent and control this devastating disease.

Conflict of interest

The authors have no conflict of interest.

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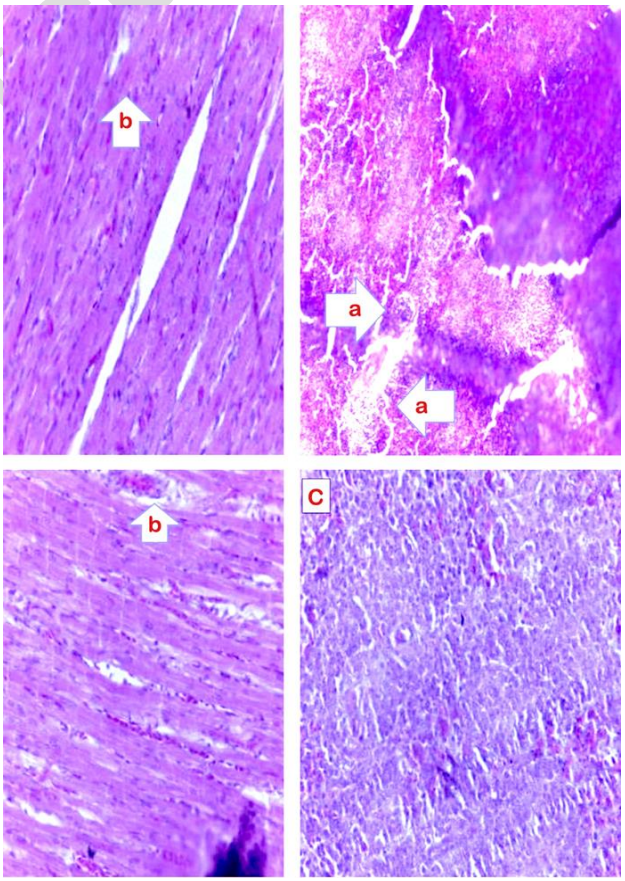

Fig. 2: Histopathological lesions of IBD in young chickens. Mild congestion of thickened wall blood vessels (A) with perivascular edema (B), lymphocyte infiltration (C). H and E; Lens: 40X.

Data Availability

The supplementary data can be available from the corresponding author on a reasonable request.

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