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Original Research Article

Gross Lesions Associated with Infectious Bursal Disease: Review of Cases (2013 – 2023) at the Avian Clinic, Veterinary Teaching Hospital, Ahmadu Bello University Zaria, Nigeria

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Abstract: Infectious bursal disease (IBD) is a significant viral infection of poultry caused by IBD virus (IBDV), resulting in severe economic losses. In this study, we reviewed gross lesions associated with IBD diagnosed at the Avian Clinic, Veterinary Teaching Hospital, Ahmadu Bello University, Zaria, Nigeria, from January 2013 to December 2023. Data were collected from the record book of the Avian Clinic, entered into Microsoft Excel sheet, cleaned and exported to Statistical package for Social Sciences (SPSS version 27) for analyses. Outcomes revealed that IBD constituted 13.0% of the 1,922 cases recorded, with the highest cases in 2023 (33.9%) and 2022 (33.8%), and the lowest in 2013 (5.8%). Gross lesions were mostly (88.4%) observed in the bursa of Fabricius, and these included enlargement (65.1%), turgidity (60.6%), oedema (17.3%), and haemorrhages (33.7%). Other affected organs included the pectoral/thigh muscles (73.9%) with congestion and haemorrhages (47.8% each), and liver (65.5%) with congestion (28.5%) and pallor (27.3%). There were haemorrhages in the proventriculus (53.8%), ventriculus (8.4%), proventriculus-ventriculus junction (10.0%), duodenum (50.6%), jejunum (16.5%), ileum (11.2%), and caecum (9.2%) and trachea (27.3%), and lung congestion (35.7%). The air sacs were cloudy (21.7%) and showed air sacculitis (4.0%). The kidneys were congested (15.7%) and pale (18.9%), with urates (2.0%); the gallbladder was distended with bile (16.1%) and congested (2.4%). This study emphasises the multi-organ involvement in IBD, thus, the need to strengthen control measures. The findings contribute valuable information on IBD pathology and can assist veterinarians and poultry farmers in improving disease management and prevention.

Keywords: Infectious bursal disease, gross lesions, avian clinic, veterinarians, poultry farmers.

INTRODUCTION

Infectious bursal disease (IBD), also known as Gumboro disease, is a highly contagious viral infection that primarily affects young chickens, induces immunosuppression and increases their susceptibility to other infections (Orakpoghenor *et al*., 2020; Du *et al*., 2023). The disease is caused by the infectious bursal disease virus (IBDV), a double-stranded RNA virus belonging to the *Birnaviridae* family (Ramzy *et al*., 2024). Infectious bursal disease is of great economic importance to the poultry industry globally due to its high mortality rate and the long-term immunosuppressive effects it induces, especially in birds between 3 and 6 weeks of age (Orakpoghenor *et al*., 2020; Du *et al*., 2023). The virus primarily targets the bursa of Fabricius (BF), but also infect the spleen and thymus (Orakpoghenor *et al*., 2021; Liu and Huang, 2024).

Infectious bursal disease is mainly transmitted via direct contact with infected birds or through contaminated feed, water, equipment, and personnel. The

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virus is highly stable in the environment and can persist for long periods, thus, making it difficult to eradicate from infected premises. Clinical signs of IBD include severe depression, ruffled feathers, diarrhoea, and dehydration. However, the most significant aspect of the disease is the gross pathological changes observed in affected birds, especially in the BF, where the virus primarily replicates (Orakpoghenor *et al*., 2020; Du *et al*., 2023). Therefore, gross lesions are critical for the diagnosis of IBD in the field, and are often confirmed by histopathological examination (Adino and Baye, 2022).

In Nigeria, IBD has been a major concern for poultry farmers, with numerous outbreaks reported over the years, despite widespread vaccination efforts and biosecurity measures (Orakpoghenor *et al*., 2020; Du *et al*., 2023; Nwagbo *et al*., 2023). This persistence may be partly attributed to the insufficient documentation of gross lesions and poor understanding of the distribution patterns of IBD cases, hence the need for localised data. Moreover, IBD can cause gross lesions in various organs, which can vary in severity and appearance. Thus, an understanding of which organs are primarily affected and the nature of the gross lesions in these organs is vital for accurate diagnosis, effective treatment, and improved prognosis. The absence of this localised data tends to limit the development of accurate diagnostic protocols and treatment interventions, which further complicates disease control efforts in poultry farms within and outside Kaduna State, Nigeria.

The Avian Clinic at the Veterinary Teaching Hospital (VTH), Ahmadu Bello University, Zaria, has been a prominent centre for the diagnosis of, and provision of management strategies for IBD cases in the region. From January 2013 to December 2023, the clinic recorded several cases of IBD, which are characterised by several gross lesions, thus, emphasising the persistent nature of the disease in the area.

MATERIALS AND METHODS

Location of the study

The study was conducted at the Avian Clinic of the Veterinary Teaching Hospital (VTH), Ahmadu Bello University (A.B.U.), Zaria, Kaduna State, Nigeria. At the Avian Clinic of the VTH, A.B.U. Zaria, postmortem examinations are conducted on the carcasses of poultry presented so as to diagnose diseases and establish the cause of mortality.

Study design

A retrospective design was adopted, and the study reviewed the lesions of IBD cases diagnosed at the Avian Clinic, VTH, A.B.U. Zaria, Kaduna State, Nigeria from January 2013 to December 2023.

Data extraction

Data were obtained from the record book of the Avian Clinic of the VTH, A.B.U. Zaria, Kaduna State, Nigeria. Infectious bursal disease diagnosed in poultry whose data were incomplete or not recorded were not included in this study. The data variables extracted were year in which IBD was diagnosed, gross lesions recorded, and the organs affected. A total of 1,922 cases were recorded, from January 2013 to December 2023, at the Avian Clinic, VTH, A.B.U. Zaria, Nigeria.

Data analyses

Data were checked for completeness, entered and cleaned in Microsoft office excel version 2013, and later exported to Statistical Package for Social Sciences (SPSS version 23.0) for analysis. The data were expressed as frequencies and percentages, and presented using charts.

RESULTS

Overall occurrence and yearly distribution of infectious bursal disease

Out of the 1,922 cases recorded, 13.0% were diagnosed as IBD, with the highest IBD cases recorded in 2023 (33.9%) and 2022 (33.8%), and the least in 2013 (5.8%). The proportions of IBD cases recorded in the years 2014, 2015, 2016, 2017, 2018, 2019, 2020, and 2021 were 9.4%, 8.9%, 27.3%, 10.0%, 18.2%, 12.9%, 13.7%, and 14.2%, respectively (Figure 1).

Distribution of organs/tissues with gross lesions due to infectious bursal disease

The organ/tissue with the highest gross lesions, out of the IBD cases, was the bursa of Fabricius (88.4%), followed by the pectoral/thigh muscles (73.9%), liver (65.5%), proventriculus (64.7%), duodenum (53.0%), spleen (49.8%), caecal tonsil (41.0%) and kidney (40.6%), and the least in the crop (2.0%) (Figure 2). The other organs/tissues with gross lesions were the trachea (33.3%), lungs (38.6%), air sac (29.7%), heart (16.1%), ventriculus (10.0%), jejunum (17.3%), ileum (11.2%), gall bladder (18.5%) and pancreas (8.4%) (Figure 2).

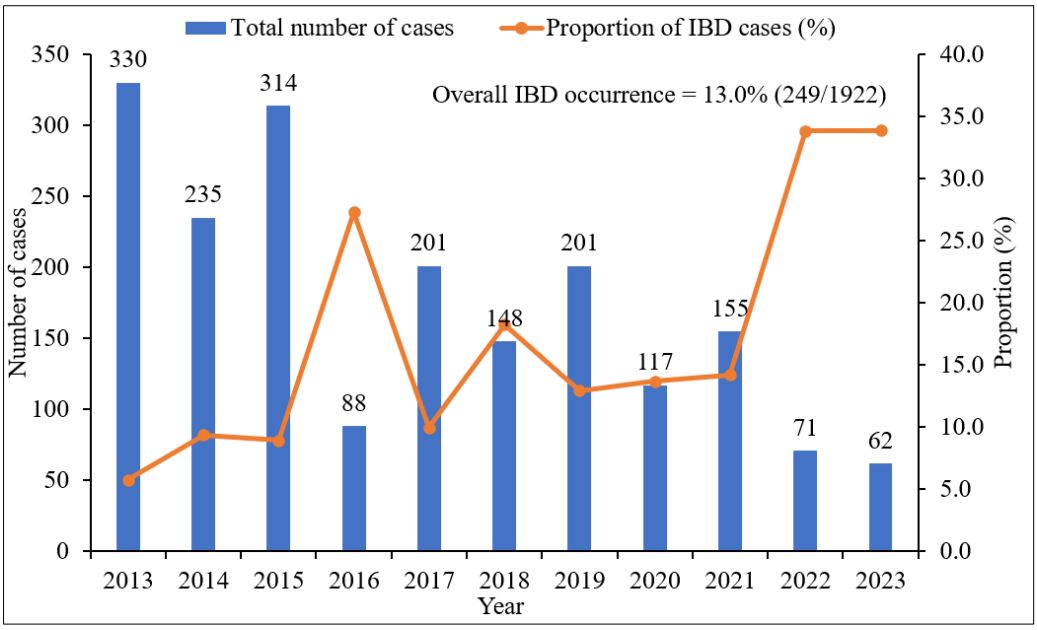

Figure 1: Occurrence of infectious bursal diseases cases diagnosed, from January, 2013 to December, 2023, at the Avian Clinic of the Veterinary Teaching Hospital, Ahmadu Bello University Zaria, Nigeria

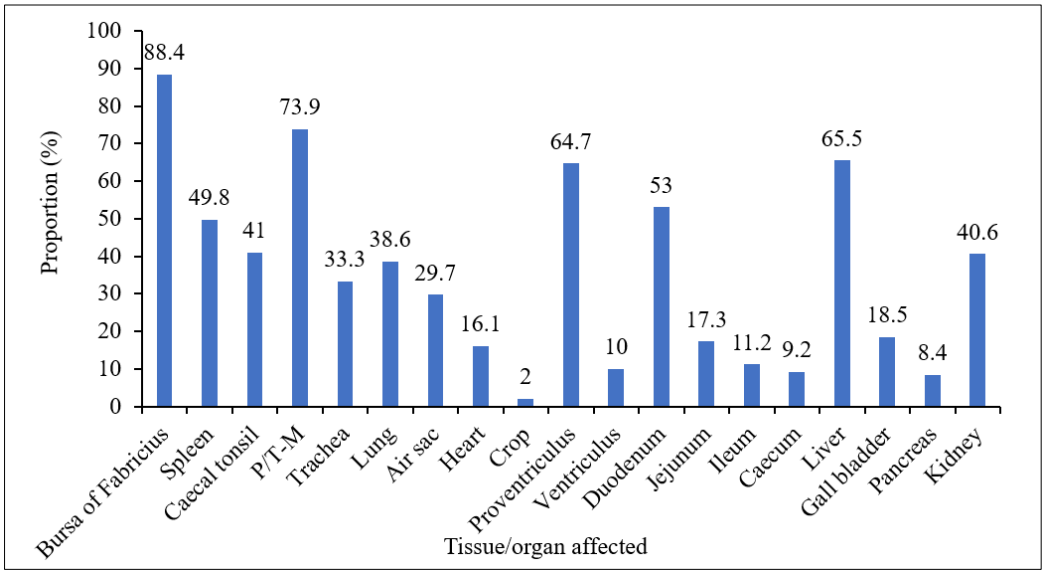

Figure 2: Distribution of organs/tissues with gross lesions in chickens diagnosed with infectious bursal disease, from January, 2013 to December, 2023, at the Avian Clinic of the Veterinary Teaching Hospital, Ahmadu Bello University Zaria, Nigeria

Distribution of gross lesions in specific organs/tissues

Bursa of Fabricius, spleen and caecal tonsils

In the bursa of Fabricius, the most lesions recorded were enlargement (65.1%), turgidity (60.6%), Oedema (17.3%) and haemorrhages (33.7%) out of the 249 IBD cases (Figure 3). The spleens were mostly congested (35.3%), enlarged (8.4%), pale (5.2%) and rough (4.8%). Haemorrhages were the most (36.9%) lesions in the caecal tonsils, and the least, congestion (2.8%) and enlargement (2.8%) (Figure 3).

Pectoral/thigh muscles

The most frequent lesions in the pectoral/thigh muscle were congestion (47.8%) and haemorrhages (47.8%), followed by loss of muscle mass (2.0%), and the least, paleness (0.8%) (Figure 4).

Trachea, lung, air sac and heart

In the trachea, the lesions recorded were haemorrhages (27.3%) and presence of mucus (16.5%) (Figure 5). Congestion constituted the most (35.7%) and paleness, the least (2.8%) lesion recorded in the lungs. The air sacs were mostly cloudy (21.7%), had air sacculitis (4.0%), congestion (2.0%) and haemorrhages (2.0%). In the heart, the lesions recorded were congestion (9.6%), haemorrhages (2.4%), hydropericardium (2.0%), and loss of coronary fat (2.0%) (Figure 5).

Crop, proventriculus, ventriculus, liver and gall bladder

In the crop, 1.6% were empty and 0.4% filled with feed (Figure 6). Most (53.8%) lesions in the proventriculus were haemorrhages with 10.0% haemorrhages at the proventriculus-vetriculus junction, and prominent proventricular glands (11.2%). Hamorrhages constituted the only lesion recorded in the ventriculus (8.4%) (Figure 6).

The livers were congested (28.5%), discoloured (5.2%), enlarged (3.6%), and pale (27.3%) and had haemorrhages (0.8%), while the gall bladders were congested (2.4%) and distended with bile (16.1%) (Figure 6).

Duodenum, jejunum, ileum, caecum, pancreas and kidney

There were congestion and haemorrhages in the duodenum (2.4%, 50.6%) and jejunum (0.8%, 16.5%), haemorrhages only in the ileum (11.2%) and caecum (9.2%) (Figure 7). The lesion recorded in the pancreas was prominent glands (8.4%). The kidneys were congested (15.7%), enlarged (6.4%), discoloured (1.2%), pale (18.9%), and had urates (2.0%) (Figure 7).

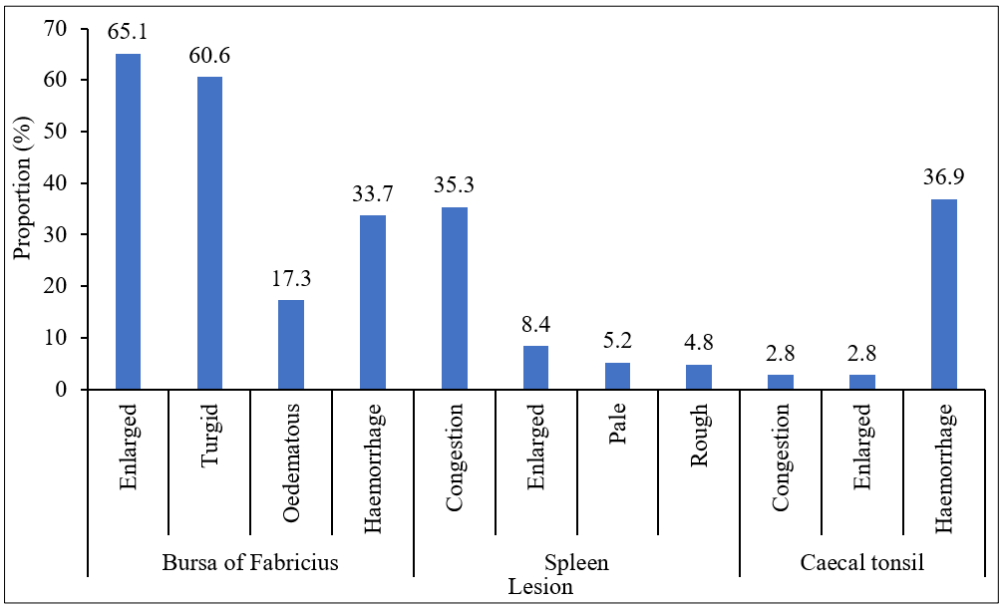

Figure 4.4: Gross lesions in the pectoral and thigh muscles of chickens diagnosed with infectious bursal disease, from January, 2013 to December, 2023, at the Avian Clinic of the Veterinary Teaching Hospital, Ahmadu Bello University Zaria, Nigeria

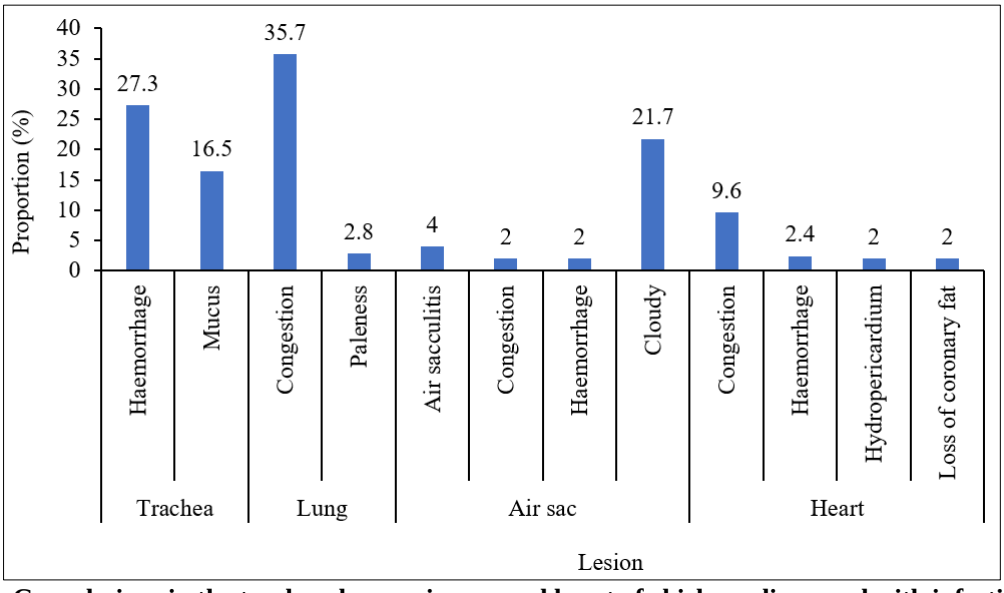

Figure 4.5: Gross lesions in the trachea, lungs, air sacs and heart of chickens diagnosed with infectious bursal disease, from January, 2013 to December, 2023, at the Avian Clinic of the Veterinary Teaching Hospital, Ahmadu Bello University Zaria, Nigeria

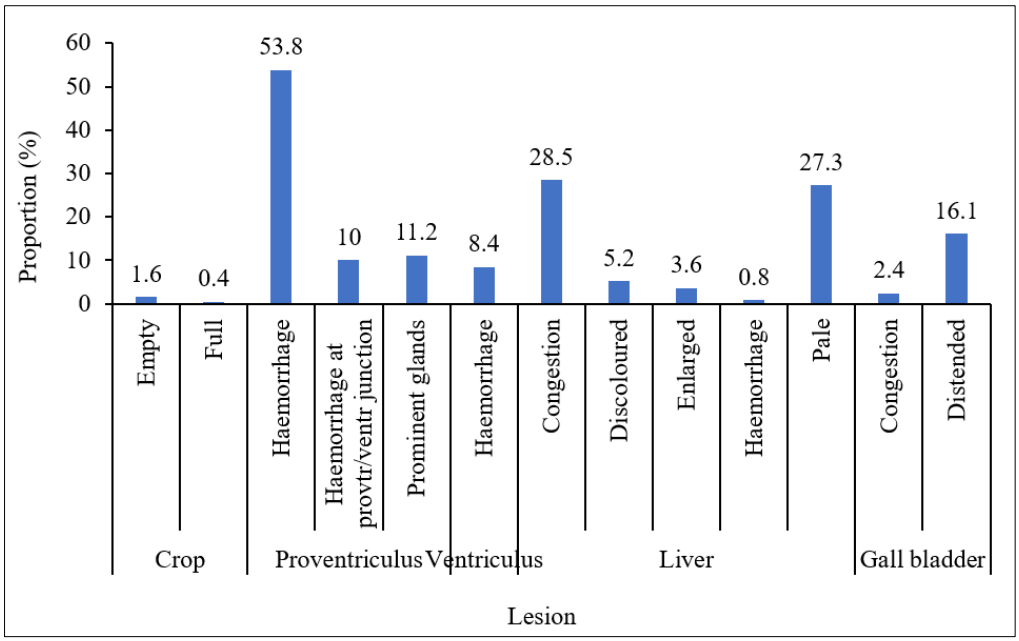

Figure 4.6: Gross lesions in the crop, proventriculus, ventriculus, liver and gall bladder of chickens diagnosed with infectious ursal disease, from January, 2013 to December, 2023, at the Avian Clinic of the Veterinary Teaching Hospital, Ahmadu Bello University Zaria, Nigeria

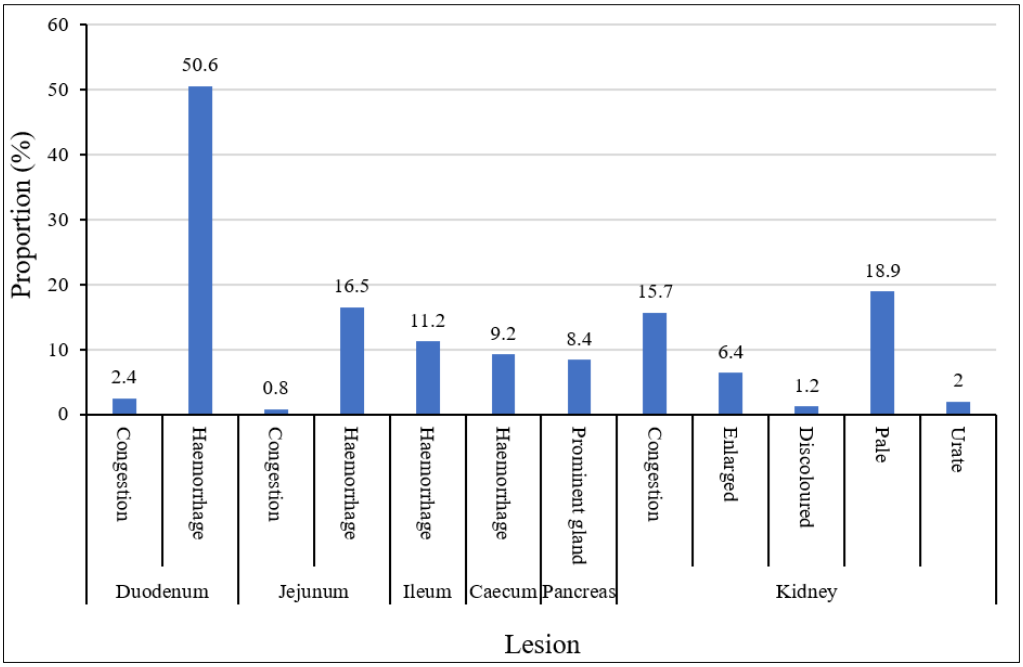

Figure 4.7: Gross lesions in the duodenum, jejunum, ileum, caecum, pancreas and kidneys of chickens diagnosed with infectious bursal disease, from January, 2013 to December, 2023, at the Avian Clinic of the Veterinary Teaching Hospital, Ahmadu Bello University Zaria, Nigeria

DISCUSSION

The overall occurrence and yearly distribution of IBD at the Avian Clinic of VTH, A.B.U. Zaria, revealed a fluctuating trend over the study period, with the highest proportions observed in 2023 (33.9%) and 2022 (33.8%). These findings align with recent reports that indicate a resurgence of IBD in various regions, possibly due to emerging virulent strains or lapses in vaccination efficacy (Legnardi *et al*., 2023; Li *et al*., 2023; Salaheldin *et al*., 2024). The low occurrence in 2013 (5.8%) and subsequent increases may reflect a combination of factors such as increased awareness, better diagnostic capabilities at the clinic, increasing poultry populations, and potential changes in viral virulence or environmental conditions that led to more reported cases (Dey *et al*., 2019; Liebhart *et al*., 2023). Also, these fluctuations in IBD incidence could be linked to poor biosecurity, inconsistent vaccination strategies and/or the presence of maternal antibodies that protect

young chicks during their early life (Hassan *et al*., 2018; Dey *et al*., 2019; Orakpoghenor *et al*., 2023).

The distribution of organs and tissues with gross lesions due to IBD is consistent with findings from previous studies, which highlighted the bursa of Fabricius (BF) as the primary organ affected by the virus (Akter *et al*., 2017; Orakpoghenor *et al*., 2021; Du *et al*., 2023). In this study, most of the IBD cases showed gross lesions in the BF, thus, validating its role as the target organ of the disease. The relatively high involvement of pectoral and thigh muscles, liver and proventriculus is consistent with findings from studies that associate IBD with lesions in these organs, possibly due to the systemic nature of the disease and viral replication in multiple tissues (Akter *et al*., 2017; Orakpoghenor *et al*., 2021). In comparison, a study in Egypt also noted significant liver lesions in IBD cases, and this could indicate a widespread impact of the virus on various organs (Gewaily *et al*., 2023).

However, certain observations, such as the low proportion of lesions in the crop and ventriculus, are consistent with previous research, which suggests that these organs are less commonly affected (Akter *et al*., 2017). The variation in lesion distribution across other organs, such as the caecal tonsils and spleen, could be influenced by the strain of the IBDV, the immune status of the birds, and management factors. The possible reasons for the observed trends, particularly increased involvements of the liver, proventriculus, and duodenum, may be related to the secondary effects of immunosuppression caused by IBD. This could have predisposed the birds to secondary infections which may have exacerbate the gross lesions in these organs (Akter *et al*., 2017; Trapp and Rautenschlein, 2022; Damairia *et al*., 2023).

The lesions recorded for the BF, spleen, and caecal tonsils have been documented for IBD, especially in cases of virulent strains. The high occurrence of enlargement and turgidity in the BF is consistent with the role of the tissue as a primary target for the virus, which causes inflammation and immune suppression. Oedema and haemorrhages further reflect the destructive nature of IBD on lymphoid tissues (Orakpoghenor *et al*., 2021). The congestion and haemorrhages in the spleen and caecal tonsils also suggest a systemic response to the viral infection, as the body attempts to respond against the immune suppression caused by the disease. The lower occurrence of congestion and enlargement in the caecal tonsils might indicate that these organs are less severely affected in some cases, and this is dependent on the virulence of the IBDV strain.

The congestion and haemorrhages in the pectoral/thigh muscles are muscular lesions that were previously documented in IBD cases (Orakpoghenor *et al*., 2021). These lesions could indicate a more severe or prolonged infection, whereby there is extension of the systemic vascular damage to the muscles. The possible mechanisms might include virus-induced deficiency in the coagulation cascade resulting from disseminated intravascular coagulopathy, endothelial cells damage, prolonged whole blood recalcification time (WBRT), prothrombin time (PT), activated partial thromboplastin time (APTT) or a combination of these changes (Zeryehun *et al*., 2012; Orakpoghenor *et al*., 2021). The loss of muscle mass and pallor might be related to secondary nutritional or metabolic stress in the affected birds, as the disease has been documented to cause anorexia and decreased feed intake (Dey *et al*., 2019; Orakpoghenor *et al*., 2020).

The lesions recorded in the respiratory system such as haemorrhages in the trachea and lungs may reflect vascular damage, possibly exacerbated by co-infections or poor air quality. The presence of mucus in the trachea, cloudiness in the air sacs, and air sacculitis suggest that respiratory involvement may result from immune suppression and increased susceptibility to opportunistic infections (Qin and Zheng, 2017; Trapp and Rautenschlein, 2022). The presence of hydropericardium and loss of coronary fat in the heart lesions may further points to systemic impacts of IBD, particularly in more severe or prolonged cases. These findings align with studies that highlight the involvement of secondary infections and the role of stress factors in exacerbating IBD lesions across different organ systems (Qin and Zheng, 2017; Trapp and Rautenschlein, 2022).

The findings in the crop, proventriculus, and ventriculus show a minimal degree of involvement in IBD cases, with only 1.6% of crops being empty and 0.4% filled with feed. This may suggest that IBD has a limited direct effect on the crop itself, thus, aligning with previous research that primarily associates IBD with immune and lymphoid tissues rather than the alimentary canal (Igwe *et al*., 2017; Li *et al*., 2018). The proventriculus, however, showed a significant occurrence of haemorrhages and haemorrhages at the proventriculus-ventriculus junction. This may indicate that the disease causes vascular damage in the digestive system. The prominence of proventricular glands is suggestive of glandular hypertrophy, and this might be a secondary response to stress or inflammation caused by IBD. Haemorrhages in the ventriculus are consistent with systemic effects of the disease on vascular integrity, but overall, the low frequency of lesions in these regions may suggest they are not primary targets of the disease (Igwe *et al*., 2017; Li *et al*., 2018).

The liver was significantly affected, with congestion and pallor being the most common findings. These changes are likely indicative of hepatic dysfunction, secondary to systemic impact of IBD and immune suppression. Also, the liver congestion and discolouration may result from the viral damages on the immune system, which can predispose birds to circulatory compromise or secondary infections

(Orakpoghenor *et al*., 2021). The presence of haemorrhages in the liver further supports this speculation. The distension of the gallbladder with bile may suggest biliary stasis, potentially due to systemic stress or dysfunction in liver metabolism, while congestion in 2.4% of cases is likely a reflection of the overall vascular impact of the disease as previously suggested.

In the intestinal tract, haemorrhages were the most frequent lesions observed, particularly in the duodenum, ileum, and caecum, and these highlights the role of IBD in causing gastrointestinal damage beyond the lymphoid organs. The congestion recorded in the duodenum and jejunum aligns with the vascular damage seen throughout the body in severe cases of IBD. The prominence of pancreatic glands in 8.4% of cases, although a minor finding, could reflect secondary effects due to systemic inflammation or immune stress. The kidneys were also notably affected, with congestion and pallor being frequent, indicating compromised renal function, which could be related to dehydration, circulatory issues, or secondary infections. The presence of urates further emphasises the renal impact of IBD, likely caused by dehydration or kidney damage in severely affected birds (Orakpoghenor *et al*., 2021; Franciosini and Davidson, 2022).

CONCLUSION AND RECOMMENDATION

In conclusion, these findings reflect the multi-organ systemic nature of IBD, thus, 13mphasizing its complexity and widespread pathological effects, and the need to strengthen control measures. The findings contribute valuable information on IBD pathology, and can assist veterinarians and poultry farmers in improving disease management and prevention.

Limitations of the study

The study relied solely on gross lesions recorded, and these may be inaccurate as it lacked confirmation through other diagnostic techniques like histopathology, serology, or molecular testing, which are essential for definitive diagnosis. Also, data were limited to cases presented at the Avian Clinic, VTH, A.B.U. Zaria, hence, this excluded cases managed outside the institution. Furthermore, the retrospective nature of the study may have resulted in incomplete or missing clinical records, which could affect the accuracy of the case data over the study period.

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