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Prevalence of Common Diseases in Kabul City Broiler Chicken Farms through the Evaluation of Macroscopic Pathological Changes

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ABSTRACT

The poultry industry is vital to the nation's livestock sector, ensuring food security and bolstering economic stability. However, the persistent occurrence of diseases presents a significant challenge, jeopardizing poultry's health and productivity and causing substantial financial losses for farmers. These challenges threaten farmers' livelihoods and the industry's overall sustainability. This cross-sectional study, conducted between August and mid-October 2023, aimed to assess the prevalence of significant poultry diseases to inform effective prevention and mitigation strategies. Findings revealed chronic respiratory disease as the most prevalent condition, affecting 22% of the surveyed chickens, followed by ascites and intestinal inflammation (16% each), infectious bronchitis (12%), infectious bursal disease (10%), and coccidiosis (8%). Identifying common disease strains through polymerase chain reaction (PCR) testing is recommended to address these challenges. These insights should guide the development of targeted vaccines, enabling the industry to manage disease outbreaks better and ensure long-term sustainability.

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INTRODUCTION

On a global scale, the world's population is increasing at an accelerating rate (Sangary et al., 2024), which, in turn, has led to a growing demand for meat and eggs worldwide. Due to the increase in demand for eggs and chicken meat, the poultry industry has experienced significant growth over the last decade (FAO, 2023). A report released by the United Nations Food and Agriculture Organization (FAO) predicted that the number of chickens globally will reach over 34 billion pieces by 2023, a figure representing a threefold increase from 1990. Regarding numbers calculated based on the continent, it can be said that 45% of all chickens in the world are grown in Asia. By 2024, more than 104 million metric tons of chicken meat will be produced worldwide. In 2021, China ranked as the world's biggest chicken meat producer, followed by the United States of America (USA) and Brazil (Chickenfans, 2023). As a percentage of all meat produced around the world, chicken meat represents 40% of all meat produced (Naushad et al., 2021).

The World Bank statistics indicate that 70% of the population of Afghanistan still lives and works in rural areas, and around 61% of Afghan families rely on this sector for their daily lives (The World Bank, 2018). It is key to the livelihoods of rural families and the suburbs of big cities to keep livestock, especially chickens, which are their major income source. According to the survey results of 2002 and 2004, more than 13 million chickens were kept in Afghanistan, 99% of which were backyard chickens, most of which were raised by women. It was estimated that each family kept about six chickens on average (Samadi & Zadran, 2023). No reliable figures are available regarding the number of meat and egg chickens in the country. The poultry sector has developed significantly in recent years in the country. Now, about 10,000 large and small farms (large farms with more than 15,000 and small farms with less than 1,000 chickens) of broiler, egg, and breeder chickens have been established across the country, which is a good source of income for the majority of people (Samadi & Zadran, 2023). Nearly 9 thousand farms are broiler chickens, and more than 600 are egg-laying hens (Mousavi, 2019). It is estimated that about one billion US dollars have been invested in this field. Approximately 120 thousand individuals are directly and more than 300 thousand indirectly working in the sector, now producing the country's most significant part of chicken meat. (Mousavi, 2019; Samadi & Zadran, 2023). According to the Ministry of Agriculture, Irrigation and Livestock (MAIL) figures, poultry farms in the country produce 219 thousand tons of chicken meat and 340 million eggs yearly. The country's domestic consumption reaches 295 thousand tons of chicken meat annually. However, now domestic production meets 80% of the country's needs for meat and eggs (Mousavi, 2019). The meat per person in Afghanistan is about 23 grams per day, which is very low compared to neighboring countries. A human needs an average of 120 grams of meat daily (Samadi & Zadran, 2023).

In most developed countries, chicken meat is considered a cheap source of animal protein and a high-quality food for humans. Chicken meat is one of the foods rich in protein, vitamins, and minerals (Naushad et al., 2021). The low price of poultry products and their abundance of nutrients are among the main factors in the industrialization of this sector. In addition, population growth, high demand for animal-source protein, and urbanization are other factors in the sector's development. Progress in breeding and disease control has led to the creation of egg and meat chickens, which in turn has increased the production of the poultry sector (Ayaz et al., 2018).

In addition to the lack of an internally produced quality poultry diet and poor management system, the spread of various infectious diseases is also considered one of the major factors causing financial losses to poultry farmers. The mortality rate of chickens due to various diseases varies between 20 and 50%, and during epidemics, this rate reaches 80% and even higher (Elbers et al., 2004). Timely diagnosis, appropriate treatment, and effective preventive measures can prevent huge financial losses to the sector.

Infectious diseases, including highly pathogenic avian influenza, Newcastle Disease (ND), Infectious Laryngotracheitis (ILT), Infectious Bronchitis (IB), Infectious Bursa Disease (IBD), salmonellosis, Chronic Respiratory Disease (CRD) not only reduce egg and meat

production but also severely affect the export of chicks and their products around the world (Elbers et al. al., 2004; Samadi & Zadran, 2023). In addition, the spread of these diseases affects a country's national economy through the cost of treatment, control, and eradication of the disease and the reduction of exports (Elbers et al., 2004). These diseases affect different body systems, especially the digestive and respiratory systems, which causes a decrease in egg production and mortality in chickens. Various tests such as Hemagglutination (HA), Hemagglutination Inhibition (HI), Polymerase Chain Reaction (PCR), Enzyme-Linked Immunosorbent Assay (ELISA), microbial culture, and observation of pathological changes during necropsy are used to diagnose the disease. However, most tests require special kits, materials, and professional personnel (Dormitorio et al., 2009). Observation of the macroscopic pathological changes during necropsy is one of the classic methods of disease diagnosis, based on which many chicken diseases can be diagnosed in the initial form (Küker et al., 2018).

Fewer studies are being conducted in the country about the main cause of mortality in the poultry sector, especially regarding macroscopic pathological changes. With this in mind, the research was initiated to examine the primary diseases responsible for mortality. It reduced productivity in poultry farms in Kabul, focusing on analyzing macroscopic pathological changes.

METHODS AND MATERIALS

Study Area

This research was conducted in chicken farms across Kabul city, mainly in broiler chickens. Kabul city is one of the 15 districts of Kabul province and is considered one of the most populated districts of the province. The city of Kabul, which is 1791 meters above sea level, is divided into 22 urban districts. Based on the information from the National Bureau of Statistics and Information (NSIA), in 2020, the population of this city reached about 4.8 million, approximately 14% of the country's total population.

Research Design

This cross-sectional study, initiated in August and finished in October 2024, was completed in 75 days. The post-mortem examination of dead birds (necropsy) was conducted at the Basir Satar necropsy lab, situated on Maywand Road in Kabul. Dead birds brought to this laboratory from different areas of Kabul city for disease diagnosis were examined and necropsied by an expert veterinarian doctor. In this diagnostic lab, dozens of dead chickens are brought daily for disease identification to provide the necessary treatment for the remaining flock.

Data Collection

Necropsy of dead chickens delivered to this laboratory was performed as soon as possible before post-mortem changes due to autolysis and putrefaction began. Initially, a

comprehensive history of the chicken was recorded using a pre-designed form. This form collected detailed information, including the chicken's age, time of death, symptoms exhibited, management criteria, vaccination status against the common endemic disease, and chemotherapy used for the treatment, all crucial for an accurate diagnosis. Along with this information, the number of total birds in the flock, the number of birds showing clinical signs, and the number of dead birds were also recorded.

After taking the history, the external examination of the bird was done. During the external examination of the bird, various aspects were assessed, including the presence of external parasites, signs of trauma, the condition of the comb and wattles, mucous membranes, nasal passages, external ear canals, the mouth cavity, as well as any bone fractures, joint deformities issues, and the condition of the feathers. Following the external examination, the carcass was opened, and the internal organs were carefully removed. The changes observed in various internal organs, such as the esophagus, trachea, lungs, liver, proventriculus (true stomach), gizzard, small and large intestines, spleen, heart, brain, muscles, joints, and tendons, were carefully documented. These changes included signs of swelling, shrinkage, enlargement, displacement, rupture, necrosis, fractures, bleeding, pus or mucus, and internal parasites. Any signs of nervous system diseases were also noted, offering a detailed understanding of the pathological conditions affecting the bird. The macroscopic changes observed in various internal organs were compared against the bird's history and clinical symptoms, considering the alterations associated with prevalent diseases in the region.

Data Analysis

All the data collected in a specific form was entered into MS Excel and then imported to the SPSS version 25 IBM. Descriptive statistics were employed to analyze the data. Average, frequency, percentages, tables, and graphs were created using the mentioned programs. A cross-table option was used to compare variables.

RESULTS

General characteristics

In this research, 172 chickens were necropsied from 50 farms in Kabul city. Individual poultry farmers brought 1 to 7 chickens to this laboratory for necropsy and disease diagnosis. The average age of the chickens was 25 days, with a minimum age of 4 days and a maximum of 40 days. Of all the chickens brought for necropsy, 96% were meat chickens, while only 4% were egg-laying hens. This distribution indicates a predominant focus on broiler production within the examined population (Figure 1). The gender of 96% of the chickens remained unidentified, while only 4% were categorized by sex. Among those identified, 2% were female and 2% were male. In terms of body condition, 18% of the chickens brought for necropsy were classified as obese, 48% had an average body condition, and the remaining 34% were considered thin (Figure 1). All the chicken farmers who submitted their deceased chickens for necropsy collectively managed 165,320 chickens. Consequently, each farmer

maintained a minimum of 120 chickens and a maximum of 18,000 on their farm. This range reflects the varying scales of poultry operations among the farmers in the study. Of the 165,320 chickens owned by these poultry farmers, 2.69% were found to be infected. In the history of the deceased chickens, it was noted that approximately 42% of the affected birds were consuming feed normally, while 52% were receiving less than the typical amount, and the remaining 6% were not getting any feed at all. When inquired about the water consumption of the infected birds, it was found that 76% had a normal intake, while 24% exhibited reduced water consumption compared to their typical levels.

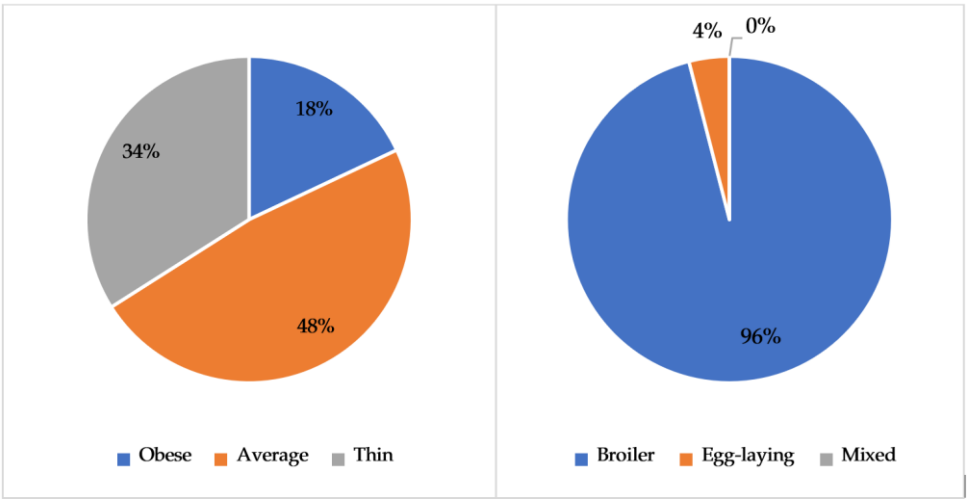

Figure 1: The figure on the upper right side illustrates the breed of the necropsied chickens, while the figure on the left side depicts the body conditions core of the chickens

Diagnosed Diseases

Of all the chickens brought for necropsy, 98% were diagnosed based on observed macroscopic pathological changes, while the remaining 2% could not be diagnosed. As a result of performing a necropsy and observing macroscopic pathological changes, various diseases such as Newcastle disease, Gumboro, intestinal inflammation, egg drop syndrome, chronic respiratory disease, infectious bronchitis, salmonellosis, and other diseases that are common in the country were diagnosed. Among all diagnosed diseases, chronic respiratory disease accounted for 22%, bronchitis for 12%, infectious bursal disease for 10%, and coccidiosis for 8%. In addition to these diseases, complications such as ascites (fluid accumulation in the abdomen) and intestinal inflammation were each recorded at a rate of 16% (Figure 2).

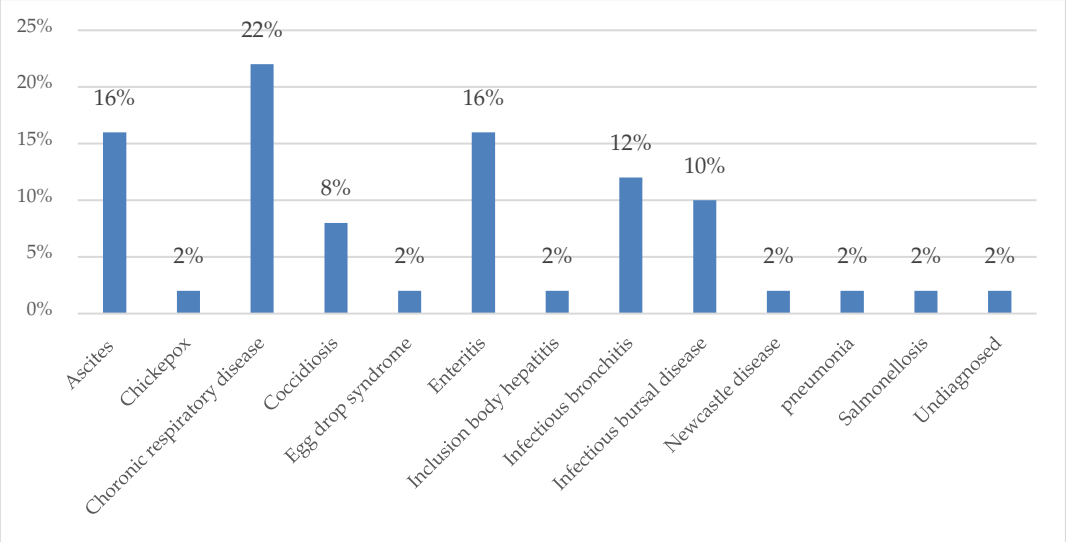

Figure 2: This figure shows the percentages of different poultry diseases diagnosed

Clinical Symptoms of Diseases

Whenever the relationship between clinical symptoms and diagnosed diseases was investigated, it was seen that out of 6 chickens with IB, 4 (66%) of them had nasal secretions as a symptom. In the same way, among 11 chickens with CRD, nasal secretions were noted in 9 (82%) of them. At the same time, among 7 chickens suffering from ascites, this clinical sign was observed in 5 chickens (71%). In 50% of the chickens, which were later diagnosed with coccidiosis as a result of necropsy, there was anemia. Eighty percent of the chickens suffering from IBD were also suffering from anemia. Dehydration and cyanosis were observed in nearly 80% of the chickens with IBD. Similarly, among the 11 chickens diagnosed with chronic respiratory disease, cyanosis was observed in 9 of them, conjunctivitis in 3, and all 11 exhibited abnormal sounds resulting from inflammation of the respiratory system. Abnormal sounds were present in all (100%) birds with IB. Additionally, most birds suffering from IBD, ascites, ND, and CRD exhibited drooping wings. Furthermore, most chickens affected by IB, IBD, and CRD displayed ruffled feathers. All chickens diagnosed with coccidiosis, ascites, IBD, CRD, and IB exhibited diarrhea. Among the clinical symptoms observed, torticollis was noted in a single chicken diagnosed with ND.

Macroscopic Pathological Changes

During the necropsy, it was noted that one chicken had black soot in its respiratory system, indicating poor management practices. This finding suggests exposure to smoke from heaters or an incomplete heating system on the farm. Tracheal hyperemia was noted in 5 of the 6 chickens diagnosed with IB, while this change was absent in the chickens suffering from other diseases. The absence of yolk sac absorption was observed in a bird affected by salmonellosis (Figure 3a). Additionally, two chickens diagnosed with infectious bronchitis exhibited enlarged livers. (Figure 3b).

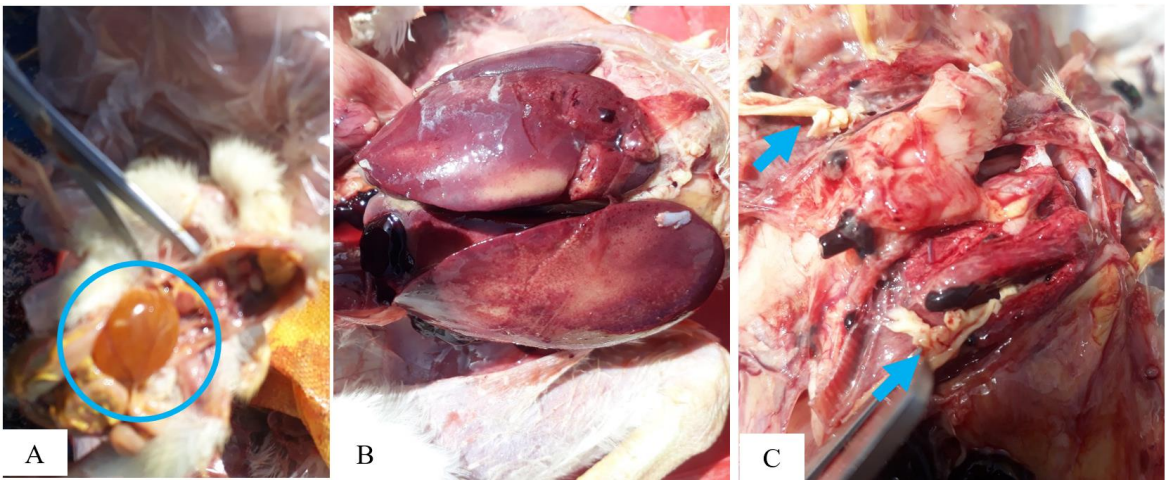

Figure 3: (A) lack of absorption of the yolk sac in salmonellosis; (B) Enlargement of the liver and the presence of inflammatory necrotic spots IB; (C) The presence of cheesy secretions in the lungs of chickens with IB

Most of the chickens diagnosed with IB were found to have pneumonia, with their lungs exhibiting cheesy secretions (Figure 3c). During the necropsy, inflammation of the air sacs was noted as one of the common symptoms of CRD. As evident, enlargement of the bursa gland is a hallmark symptom of IBD. This research observed that all the birds suffering from IBD had a large bursa (Figure 4a). In cases of coccidiosis, IB, and intestinal inflammation, the intestines exhibited the presence of gas. In the intestines of chickens with coccidiosis, there was bleeding (Figure 4 b) and hyperemia. Over 30% of birds with intestinal inflammation had undigested food in their intestines. Furthermore, one chicken affected by ND exhibited bleeding and hyperemia in the inner lining of its proventriculus (Figure 4c)

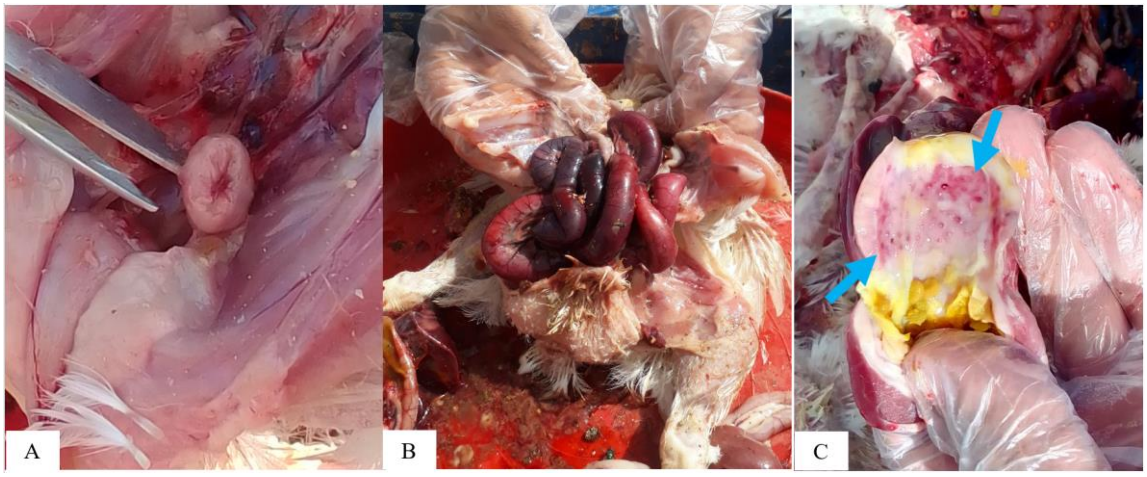

Figure 4: (A) Enlargement of the bursa in chickens with IBD; (B) Bleeding in the intestines of chickens with coccidiosis; (C) Bleeding in the actual stomach glands in chickens with ND

DISCUSSION

An analysis of the necropsy results in this study reveals that CRD, with a prevalence rate of 22%, ranks as the most common disease in the country. When comparing the results of this research with the findings of Sahab et al. (2020), who conducted a similar study based on clinical symptoms, history, and post-mortem changes in poultry farms in the Shulgarh district of Balkh province, a prevalence rate of 23% was reported. This shows a close alignment

between the two studies, indicating a consistent presence of chronic respiratory disease in different regions. The research conducted by Gupta and colleagues in 2019 in Uttar Pradesh, India, revealed that the prevalence of CRD in broiler chickens was 13.42% and 10.86% in egg-laying chickens (Gupta et al., 2019). These findings indicate a lower prevalence than this study's results, highlighting regional differences in disease occurrence.

This research found that 8% of chickens were infected with coccidiosis, while the study by Lawal et al. (2016) in Nigeria reported a significantly higher prevalence of 31.8%. To investigate the prevalence of coccidiosis, Lawal and his team examined 600 samples of intestines and stomachs through smears and microscopic tests (Lawal et al., 2016). One reason for the discrepancy between the results of this study and Lawal et al.'s findings is the diagnostic method used. Macroscopic pathological changes in coccidiosis are typically observed in the advanced stages of the disease, whereas early detection is possible through smears and microscopic identification of Eimeria oocysts. Since early-stage coccidiosis is not detectable by visualizing pathological changes alone, some chickens with early-stage infections may have gone undiagnosed in this study. A study by Ayaz et al. (2018) in southern Ethiopia revealed that 18% of necropsied chickens were infected with coccidiosis (Ayaz et al., 2018). This finding highlights the significant presence of coccidiosis in the region, similar to other studies in various locations. Similarly, research conducted by Mamun and colleagues in 2019 in Bangladesh reported a prevalence of 9.16% among broiler chickens (Mamun et al., 2019). These findings align with this research's results, showing comparable rates of coccidiosis prevalence across different regions.

This research also found that 12% of necropsied chickens were infected with infectious bronchitis. A study by Bhuiyan and colleagues in 2019, which tested swab samples and various internal organs using polymerase chain reaction (PCR), showed that 11.94% of broilers were infected with infectious bronchitis (Bhuiyan et al., 2019). These results closely align with the findings of this research, indicating a similar prevalence of the disease. The research published by Mamun et al. (2019) found the prevalence of infectious bronchitis in Bangladesh to be 9.79%. Similarly, a study by Sahab et al. (2020) reported a 7% disease prevalence in Balkh province. These findings indicate that the prevalence of infectious bronchitis varies across regions but remains a notable health concern in poultry populations.

Similarly, necropsy examinations in this research revealed that 10% of the chickens were infected with infectious bursal disease. A study by Giasuddin and colleagues (2002) conducted post-mortem examinations on 1,653 dead and diseased chickens in Bangladesh found that 11.8% of the chickens were infected with infectious bursal disease (Giasuddin et al., 2002). These findings are closely aligned with the results of this research, showing a similar prevalence of the disease. Another study by Sahab and colleagues reported that the prevalence of IBD among broiler farms in the Shulgarh district of Balkh province reached 8% (Sahab et al., 2020). These findings are closely aligned with the results of this research, further indicating a consistent prevalence of the disease across the country. Likewise, the findings from the research conducted by Mamun and colleagues indicate that the prevalence

of IBD among broiler chickens ranged from 9% to 16% (Mamun et al., 2019). These results are in complete agreement with the findings of this research, further supporting the consistency of IBD prevalence in different studies.

Of all the necropsied chickens, 2% were infected with ND. In contrast, the research conducted by Sahab and colleagues reported a prevalence of 10% in poultry farms in Shulgarh, Balkh province (Sahab et al., 2020). This indicates a discrepancy between Sahab et al.'s findings and the results of this research, highlighting variations in disease prevalence across different provinces. In a study published by Orsi and colleagues in 2010, blood samples and tracheal and cloacal swabs were collected from 23,745 broiler chickens, and the samples were analyzed through the ELISA test for ND. Their findings indicated that 39.1% of the chickens tested positive for the disease (Orsi et al., 2010). The results from Orsi et al.'s research do not align with the findings of this study, and the discrepancy in disease prevalence may be attributed to the differing methods and their accuracy used in investigation.

Additionally, this study found that 16% of the chickens were affected by ascites. In comparison, various studies indicate that the prevalence of ascites in different countries is around 4.7% (Baghbanzadeh & Decuypere, 2008). Several factors contribute to the development of ascites in chickens, the most significant being internal organ diseases, particularly those affecting the liver and kidneys. Effective farm management practices, including balanced nutrition and proper ventilation, are crucial in preventing this condition. Furthermore, research suggests that genetics or heredity may also play a role in the occurrence of ascites in chickens. Modified egg and meat chickens can produce a high volume of eggs and meat in a relatively short timeframe. This increase in production corresponds to a greater demand for oxygen; however, the cardiopulmonary system of these chickens has not significantly evolved compared to birds from 40 years ago. Consequently, their lung capacity often fails to meet their oxygen requirements, particularly under challenging conditions such as high ambient temperatures or elevated altitudes. Insufficient oxygen in the body results in hypoxia, which subsequently leads to the accumulation of fluid in the chickens' abdominal cavity.

Intestinal inflammation is another pathological change observed, with a prevalence of 16% among the necropsied chickens. Research conducted by Sahab and colleagues indicated that the prevalence of intestinal inflammation among chickens in the Shulgarh district of Balkh was 9%, with necrotic intestinal inflammation accounting for 6%. Sahab et al.'s study assessed the prevalence of intestinal and necrotic intestinal inflammation separately. In contrast, this research categorized all forms of intestinal inflammation under the broader term "intestinal inflammation." Therefore, the prevalence of intestinal inflammation in this study aligns closely with the findings of Sahab et al., which reported a prevalence of 15% (Sahab et al., 2020).

CONCLUSION

The findings of this research indicate that various bacterial and viral diseases are prevalent in broiler farms in Kabul. Chronic respiratory disease is the most common among these, followed by conditions such as abdominal water accumulation, intestinal inflammation, infectious bronchitis, infectious bursal disease, and coccidiosis. These diseases result in significant economic losses for poultry farmers each year and considerably impact the poultry sector, which is nearing self-sufficiency. Therefore, it is recommended that the prevalence of diseases in Kabul be assessed using high-precision tests with adequate sensitivity and specificity. Additionally, vaccines should be developed to target the common strains present in the region.

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