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Research Article

Avian Colibacillosis: A Review of Cases (2013 – 2023) Diagnosed at the Avian Clinic of the Veterinary Teaching Hospital, Ahmadu Bello University Zaria, Kaduna State, Nigeria

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Authors:
Muhammed Shuaib Muhammed[1], Ochuko Orakpoghenor[2], Charles Adakole Onuh[1], Garleya Bilbonga[1,7], Innocent Chiebuka Abazie[3], Aminat Gogo Muhammed[4], Mariam Onyiohu Lawal[4], Hayatuddeen Bako Aliyu[5], Ahmad Muhammad Talba[5], Ibrahim Waziri Musa[6], Aliyu Mohammed Wakawa[6], Sunday Blessing Oladele[1] and Lawal Saidu[5]*

Affiliations:
[1]Department of Veterinary Pathology, Faculty of Veterinary Medicine, Ahmadu Bello University Zaria, Nigeria
[2]Department of Veterinary Pathology, Faculty of Veterinary Medicine, Bayero University Kano, Nigeria
[3]Department of Veterinary Services, State Ministry of Agriculture, Abia State, Nigeria
[4]Department of Human Anatomy, College of Medical Sciences, Ahmadu Bello University Zaria, Nigeria
[5]Veterinary Teaching Hospital, Ahmadu Bello University Zaria, Nigeria
[6]Department of Veterinary Medicine, Faculty of Veterinary Medicine, Ahmadu Bello University Zaria, Nigeria
[7]Department of Animal Health and Production, Federal University Wukari, Taraba State, Nigeria

***Corresponding Author:**
Ochuko Orakpoghenor. Department of Veterinary Pathology, Faculty of Veterinary Medicine, Bayero University Kano, Nigeria.

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Abstract

Avian colibacillosis, caused by Avian Pathogenic Escherichia coli (APEC), is a major economic concern for the poultry industry worldwide, leading to significant morbidity, mortality, and production losses. The aim of this study was to conduct a retrospective survey on colibacillosis diagnosed, from January, 2013 to December, 2023, at the Avian Clinic of the Veterinary Teaching Hospital, Ahmadu Bello University Zaria, Kaduna State, Nigeria. Data was extracted from the record book, entered into Microsoft Excel sheet, and analyzed using descriptive statistics. Results revealed that out of 1,922 cases presented to the Clinic, 13.1% (95% CI: 11.7 – 14.7%) were diagnosed with colibacillosis. The highest incidence occurred in 2013 (17.5%), while the lowest was recorded in 2023 (2.4%). The monthly analysis revealed a peak in February (11.9%) and June (10.7%). Chickens were predominantly affected, accounting for 96.4% of the cases, while older poultry (greater than 9-weeks-old) showed higher susceptibility (56.7%). The proportions of colibacillosis cases diagnosed showed significant ($P<0.001$) differences among the species and age groups of poultry The findings suggest that environmental factors, management practices, and age-related susceptibility may influence the incidence of colibacillosis. The study emphasizes the critical role of veterinary pathology in diagnosing and understanding the pathogenesis of colibacillosis, thus, the need for ongoing surveillance and the implementation of enhanced biosecurity measures. It provides valuable insights into the epidemiology of colibacillosis in Zaria, offering data that can inform future strategies for disease prevention and control to improve poultry health and productivity.

Keywords: Colibacillosis, Avian Clinic, Retrospective Survey, Species, Age

Introduction

Colibacillosis is a significant infectious disease in poultry, primarily caused by pathogenic strains of *Escherichia coli* i.e., Avian Pathogenic *E. coli* (APEC) [1,2]. The disease manifests as a systemic infection, leading to various clinical syndromes that can result in high morbidity and mortality rates among affected birds. Colibacillosis is particularly prevalent in commercial poultry operations, where it poses substantial economic challenges due to its association with other diseases and its impact on production efficiency [3, 4]. However, it has been isolated in broiler farms [5]. The primary contributory factors to colibacillosis include environmental stressors that compromise the immune systems of birds, and these include poor ventilation, overcrowding, and inadequate sanitation [4]. Avian Pathogenic *E. coli* strains, which are distinct from non-pathogenic *E. coli* found in the Gastrointestinal Tract (GIT), have acquired virulence factors that enhance their pathogenicity [6,7]. These virulence factors include the ability to resist phagocytosis, adhere to host tissues, and acquire iron under low-iron conditions [7]. Infection typically occurs through contaminated environments, with birds exposed to fecal matter, dust, or through direct contact with infected birds. The disease can also result from opportunistic infections following other primary diseases, thus, making it a common secondary pathogen in poultry [4]. Colibacillosis presents in various forms, including acute septicemia, aracialities, pericarditis, and salpingitis [8,9]. In young chicks, it may lead to yolk sac infections (omphalitis) or swollen head syndrome. The acute form is characterised by rapid onset and high mortality, while chronic forms may present with more subtle clinical signs. The clinical signs can include ruffled feathers, lethargy, labored breathing, and diarrhea. In laying hens, the disease often results in decreased egg production and can lead to significant economic losses during peak production periods [4]. Diagnosis of colibacillosis is primarily achieved through the isolation of *E. coli* from affected tissues or fluids. Culture techniques and serotyping are commonly employed to identify pathogenic strains [4]. Despite the availability of diagnostic services at the Veterinary Teaching Hospital (VTH), Ahmadu Bello University (A.B.U.), Zaria, there is a lack of comprehensive data on the prevalence, epidemiology, and economic impact of colibacillosis in the region. This gap in knowledge hinders the development of effective prevention and control strategies tailored to the local poultry industry. Hence, this study assessed the prevalence, temporal distribution, and patterns

of colibacillosis across different avian species and age groups using retrospective data. Findings from this study is vital for understanding the disease patterns and identifying potential risk factors associated with its occurrence.

Materials and Methods

Study location

The study was conducted in the Avian Clinic of the Veterinary Teaching Hospital (VTH), Ahmadu Bello University (A.B.U.) Zaria, Kaduna State, Nigeria. Zaria is a major city in Kaduna State, Northwestern Nigeria, located at longitude $7^0$43'11.802" E and latitude $11^0$5'7.948" N, with an average elevation of 644 m above sea level. It has a total land area of 523 km^2, a human population of 408,198 according to the 2006 census, and a density of 730/km^2. The climate in Zaria includes a wet season, lasting from April to September, and a dry season from October to March [10].

In the Avian Clinic of the VTH, A.B.U. Zaria, postmortem examinations of poultry carcasses are carried out for the purpose of diagnosing diseases and establishing the cause of mortality.

Study design

A retrospective design was adopted, and the study reviewed colibacillosis diagnosed at the Avian Clinic, VTH, A.B.U. Zaria, Kaduna State, Nigeria from January 2014 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. Colibacillosis diagnosed in poultry whose data were incomplete or not available were not included in this study. The data variables extracted were year and month, in which the colibacillosis was diagnosed, and species and age of the poultry.

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 27.0) for analysis. The data were expressed as frequencies and percentages, and presented using tables and charts. Chi-square statistic was used to test for differences in the proportion among species and age groups of poultry diagnosed with colibacillosis. Value of $P \leq 0.05$ was considered significant.

Results

Overall, and yearly and monthly trends of colibacillosis cases

A total of 1922 cases were diagnosed, from January 2013 to December 2023, at the Avian Clinic of the Veterinary Teaching Hospital, Ahmadu Bello University Zaria, Kaduna State, Nigeria. Out of these cases, colibacillosis comprised 13.1% (95% CI: 11.7 – 14.7%) (Table 1).

The yearly trend showed that colibacillosis was highest in 2013 (17.5%) followed by in 2017 (15.5%), 2014 (12.7%), 2015 (12.3%) and then lowest in 2023 (2.4%) out of the 252 colibacillosis cases diagnosed (Figure 1). Based on the monthly distribution, the highest colibacillosis cases were in February (11.9%) followed by in June (10.7%), March (10.3%), September and October (9.1%), and the lowest in December (2.8%) (Figure 2).

Species and age patterns of the colibacillosis cases

The species of poultry presented to the Clinic were chicken, duck, goose, Guinea fowl, ostrich, pigeon, parrot, peacock and turkey. Out of the 252 colibacillosis cases diagnosed, the highest was diagnosed in chicken (96.4%) followed by goose (1.6%) and turkey (1.2%), and the least (0.4%) diagnosed in Guinea fowl and pigeon (Figure 3). The proportions of colibacillosis cases diagnosed showed significant ($P < 0.001$) difference among the species of poultry (Figure 3).

Based on the age of the poultry, the highest (56.7%) colibacillosis was in poultry greater than 9-weeks-old and

Table 1: Retrospective data of colibacillosis cases diagnosed, from January 2013 to December 2023, at the Avian Clinic of the Veterinary Teaching Hospital, Ahmadu Bello University Zaria, Kaduna State, Nigeria.

Detail	Value
Total number of cases	1922
Number of colibacillosis cases	252
Number of non-colibacillosis cases	1670
Proportion of colibacillosis (%)	13.1
95% CI	11.7 - 14.7

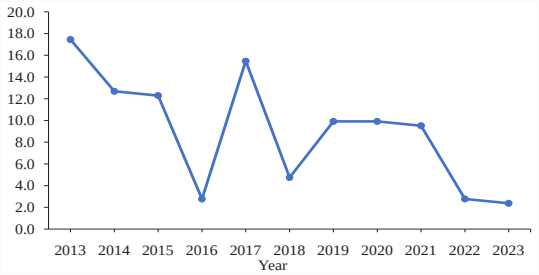

Figure 1: Yearly trend of colibacillosis cases diagnosed, from January 2013 to December 2023, at the Avian Clinic of the Veterinary Teaching Hospital, Ahmadu Bello University Zaria, Kaduna State, Nigeria.

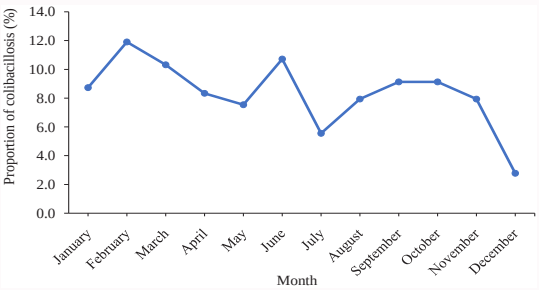

Figure 2: Monthly trend of colibacillosis cases diagnosed, from January 2013 to December 2023, at the Avian Clinic of the Veterinary Teaching Hospital, Ahmadu Bello University Zaria, Kaduna State, Nigeria.

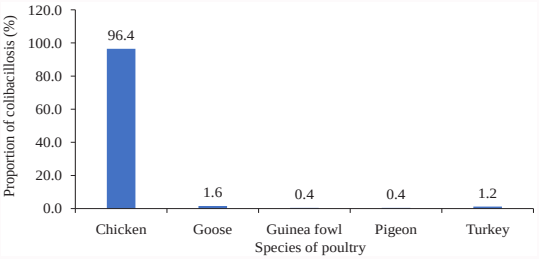

Figure 3: Species pattern of colibacillosis cases diagnosed, from January 2013 to December 2023, at the Avian Clinic of the Veterinary Teaching Hospital, Ahmadu Bello University Zaria, Kaduna State, Nigeria. P<0.001.

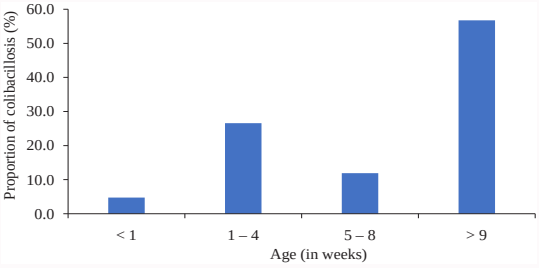

Figure 4: Age-specific pattern of colibacillosis cases diagnosed, from January 2013 to December 2023, at the Avian Clinic of the Veterinary Teaching Hospital, Ahmadu Bello University Zaria, Kaduna State, Nigeria. P<0.001.

lowest (4.8%) in those less than 1-week-old. In the other age groups, the proportions of colibacillosis diagnosed were 26.6% (1 – 4-week-old) and 11.9% (5 – 8-week-old) (Figure 4). There was a significant (P <0.001) difference in the proportion of colibacillosis diagnosed among the age groups of poultry (Figure 4).

Discussion

Out of the 1922 cases diagnosed at the Clinic during the study period, colibacillosis accounted for 13.1% (252). This finding is consistent with previous studies that have reported colibacillosis as one of the most common bacterial diseases affecting poultry flocks. In Nigeria, Saidu et al. [11] reported a total of 834 cases of colibacillosis during a five-year retrospective study (1993-1997) of colibacillosis in improved poultry breeds diagnosed at the VTH, A.B.U. Zaria. Abalaka et al. [12] reported an outbreak of colibacillosis in five-week-old broiler chickens in

a commercial farm in Abuja. Agusi et al. [13] reported a 99.4% prevalence of *E. coli*in the cloacal swabs of local and exotic poultry breeds in Jos, Plateau State. Research conducted in South Korea found a higher prevalence of colibacillosis, with rates of 32.6% in broiler flocks and 27.2% in layer flocks [14]. In another study conducted in the greater Mymensingh district, Bangladesh, a prevalence of colibacillosis at 0.84% in broilers and 0.80% in layers was reported [15]. Variation in geographical location, study period in consideration, sample collection, and detection method might be responsible for these differences. The prevalence of colibacillosis highlights the need for improved biosecurity measures, vaccination programmers, and effective treatment strategies to mitigate the impact of this disease on poultry production. The yearly trend analysis revealed that colibacillosis cases peaked in 2013 (17.5%) and gradually declined over the years, with the lowest proportion observed in 2023 (2.4%). This declining trend may be attributed to improved management practices, increased awareness among poultry farmers, and the implementation of more effective control measures [4]. However, the fluctuations observed in certain years, such as the increase in 2017 (15.5%), suggests that sporadic outbreaks may still occur, possibly due to lapses in these practices or other predisposing factors like environmental stressors. The monthly trend analysis showed that colibacillosis cases were highest in February (11.9%) and lowest in December (2.8%). A previous study reported the highest numbers of colibacillosis cases in the months of January, March, April and October [11]. The increased incidence during the early months of the year, in the present study, may be associated with environmental factors, such as changes in temperature and humidity, which can influence the survival and transmission of APEC. In addition, periods of stress, such as during the early laying period or changes in feed, could also contribute to the increased susceptibility of poultry to colibacillosis during these months [4,16]. The species pattern analysis revealed that chickens were the most affected species, accounting for 96.4% of the colibacillosis cases diagnosed. This finding is consistent with the fact that chickens are the most widely reared poultry species globally and are highly susceptible to APEC infections [2,17]. The low diagnosed cases observed in other species, such as geese (1.6%), turkeys (1.2%), and Guinea fowls (0.4%), may be due to differences in management practices, genetic susceptibility, or the presence of natural resistance mechanisms. The highest proportion of colibacillosis cases (56.7%) was observed in poultry older than 9 weeks, while the lowest (4.8%) was in birds less than 1-week-old. This age-specific pattern showed variation with previous studies. Matin et al. [15] reported that the prevalence of colibacillosis was 1% in 25-30 days old broilers and 0.5% in 31-35 days old broilers; 0.6% in 40-45 days old layers and 1% in 46-50 days old layers. The study further showed that the prevalence of colibacillosis in broiler and layer at different age groups was statistically significant [15].Apostolakos et al. [16] reported that the First-Week Mortality (FWM) due to colibacillosis ranged from 1.53% to 12.6%, and emphasized the importance of systematic sampling and whole genome sequencing for a better understanding of the epidemiology of colibacillosis. Kakooza et al. [18] reported a low incidence of colibacillosis at 34.0% in chicks and a high incidence of 53.3% in end-cycle broilers. This indicated a shift in the prevalence of APEC as birds mature [18]. The age-related trend observed in the present study could be explained by the fact that younger birds may have some level of maternal antibody protection, which wanes over time, thus, leaving them more vulnerable to APEC infections as they mature [19]. In addition, older birds may be subjected to more stress factors, such as increased production demands and changes in management practices, which can compromise their immune system and increase their susceptibility to disease [20,21].

Conclusion

The findings from this study emphasize the importance of continued surveillance and implementation of effective control measures to manage colibacillosis in poultry. The observed decline in the prevalence of colibacillosis over the years is encouraging, but the sporadic spikes in cases highlight the need for sustained efforts in disease prevention. Hence, regular monitoring, vaccination, and the application of stringent biosecurity measures should be prioritized to minimize the impact of this disease on poultry health and production.

Limitations

The study was dependent only on retrospective data, which may contain incomplete or inconsistent records. Also, data were limited to cases presented at the Avian Clinic, VTH, A.B.U. Zaria, and did not include cases managed outside the institution.

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