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Occurrence and bacteriological identification of avian pathogenic *Escherichia coli* in chicken

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Abstract

Avian pathogenic *Escherichia coli* (APEC) is an important bacterial pathogen responsible for a wide range of infections in chickens, ranging from localized lesions to severe systemic disease. These infections contribute significantly to economic losses in the poultry industry due to increased mortality and reduced productivity. APEC is primarily associated with extraintestinal infections and various pathological conditions in birds. A total of 447 birds from 33 flocks were subjected to post-mortem examination, and the occurrence was reported as 11.85% based on gross lesions. The occurrence was higher in layer chickens (64.15%) than in broilers (35.84%). Age-wise distribution revealed higher occurrence in adults (58.49%), followed by growers (28.30%) and chicks (13.20%). The major pathological conditions observed included perihepatitis, pericarditis, colisepticemia, egg peritonitis, salpingitis and omphalitis.

Keywords: *Escherichia coli*, APEC, chicken, occurrence

Introduction

Over the past few decades, the poultry industry in India has experienced substantial expansion, transitioning from traditional backyard rearing systems to a highly organized and commercially intensive sector (Chatterjee and Rajkumar, 2015) [4]. India presently ranks among the leading producers of eggs and broiler meat globally, with poultry products serving as a key source of affordable animal-derived protein. Eggs and poultry meat are rich in high-quality protein and essential micronutrients, thereby playing a crucial role in enhancing nutritional security, particularly in developing countries (Kashyap and Goswami, 2024) [12]. Despite the substantial growth of the poultry sector, infectious diseases remain a significant constraint to productivity and economic returns. Among bacterial pathogens, avian pathogenic *Escherichia coli* (APEC) is widely recognized as a major etiological agent of colibacillosis in poultry (Geetha and Palanivel, 2018; Khati, 2023) [8, 13]. The disease manifests in a range of clinical conditions, including colisepticemia, polyserositis, salpingitis, egg peritonitis, omphalitis, coligranuloma, synovitis and ophthalmitis, leading to considerable economic losses through increased mortality, impaired growth performance, and elevated therapeutic costs (Dho-Moulin and Fairbrother, 1999; Abed *et al.*, 2020) [5, 1]. The pathogenic potential of APEC is primarily associated with a diverse array of virulence determinants that enable effective colonization, invasion, and persistence within the host. Furthermore, predisposing factors such as environmental stressors, concurrent infections, and immunosuppression can enhance susceptibility to infection (Ewers *et al.*, 2004; Gerson Nakazato *et al.*, 2009) [7, 17]. Although Telangana represents a major poultry-producing region in India, detailed data regarding the incidence of APEC infections remain scarce. Hence, the present study was designed to investigate the incidence of avian pathogenic *E. coli* infections in chickens.

Materials and Methods

Samples for the present study (lungs, airsacs, heart, liver, intestines, oviduct and yolk sac) were collected during necropsy of suspected birds obtained from poultry farms in and around Hyderabad, and cases submitted to the Department of Veterinary Pathology, College

of Veterinary Science, Rajendranagar, Hyderabad, during 2025. A total of 447 dead or moribund birds were subjected to detailed post-mortem examination. Representative samples from birds showing lesions suggestive of colibacillosis were collected for bacteriological analysis.

Isolation and Identification of *E. coli*

Tissue and swab specimens were enriched in nutrient broth at 37 °C for 24 hours and subsequently streaked onto MacConkey lactose agar (HiMedia). After incubation, lactose-fermenting colonies were inoculated onto EMB agar, and colonies producing a typical green metallic sheen were sub-cultured onto EMB slants and incubated at 37 °C for 24 hours. The isolates were stored at 4 °C and presumptively identified as *E. coli* by biochemical tests such as Indole, Methyl Red (MR), Voges-Proskauer (VP) and Citrate utilization assays to confirm the identity of *E. coli* according to Sahoo *et al.* (2012) [20].

Results

Occurrence of Colibacillosis

Based on cultural examinations, the overall occurrence of colibacillosis is given in Table I. Out of 447 birds examined, 53(11.85%) were positive for various forms of APEC infections. The distribution of cases based on type of chicken and age is presented in Table II. The occurrence was higher in layer chickens (64.15%) compared to broilers (35.84%). Age-wise, the highest occurrence was recorded in adults (58.49%), followed by growers (28.30%) and chicks (13.20%).

Cultural and Biochemical Characteristics

Aseptically collected swabs from the heart, liver, lungs, oviduct and yolk sac of birds with lesions suggestive of colibacillosis were subjected to cultural and biochemical analysis. All 53 isolates were identified as *E. coli* based on their cultural, morphology and biochemical profiles. The

isolates produced pink colonies on MacConkey agar and typical metallic green colonies on EMB agar (Fig. 1 and 2). All isolates were positive for Indole and Methyl Red tests and negative for Voges-Proskauer and Citrate utilization tests (Fig. 3.)



Fig 1: Culture of *E. coli* on MacConkey agar showing small pink-coloured colonies.



Fig 2: On EMB agar, *E. coli* developed as green metallic sheen colonies.

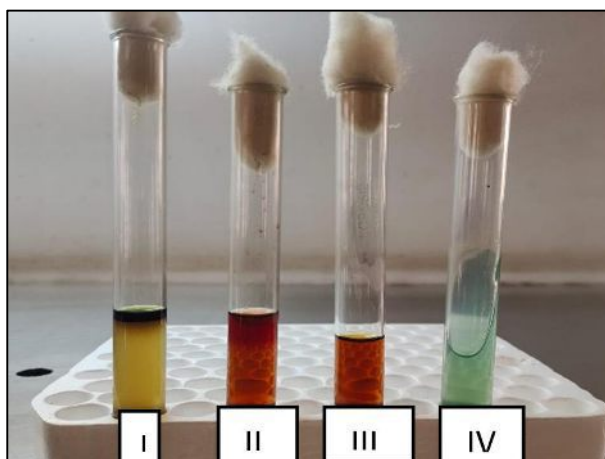


Fig 3: IMViC Test for *E. coli* (I) Positive for Indole test (II) Positive for Methyl Red test (III) Negative for Voges-Proskauer test (IV) Negative for Citrate Utilization test.

Discussion

In recent years, commercial poultry farming has expanded rapidly; however, several challenges continue to hinder its growth. Among these, poultry diseases remain a major constraint on the development and productivity of the poultry industry (Al Mamun *et al.*, 2019) [2]. Colibacillosis is a common bacterial infection in poultry that causes significant economic losses worldwide due to decreased

production performance, higher mortality rates, carcass rejection during processing, and increased expenses for prophylaxis and therapy.

In the present study, 447 dead birds were examined, of which 53 cases were confirmed as *E. coli* infection based on cultural and biochemical confirmation, indicating an occurrence of 11.85%. This finding is comparable with the reports of Hussain *et al.* (2021) [9] and Bhattacharjee *et al.*

(1996) [3], who reported 12.50% and 10.61%, respectively. However, the observed occurrence in this study was higher than that reported by Tella *et al.* (2023) [22] but lower than the occurrence reported by Shah *et al.* (2025) [19]. Variation in the occurrence of *E. coli* reported in different studies may be attributed to differences in management, hygiene, stocking density, ventilation, age of birds and immunosuppressive factors (Kika *et al.*, 2023) [15]. In addition, intensified poultry production and rapid expansion of farms may increase stress and susceptibility to infections (Panth, 2019) [18].

In the present study, colibacillosis was more frequently observed in layer chickens (64.15%) compared to broilers (35.84%), suggesting that bird type plays an important role

in disease occurrence. These findings are consistent with the reports of Hussain *et al.* (2021) [9] and Islam *et al.* (2023) [10], who also recorded higher prevalence in layers. The increased susceptibility in layers may be related to their longer lifespan, intensive housing and reproductive tract involvement.

The study revealed age-wise variation in colibacillosis, with adults showing the highest occurrence (58.49%), followed by growers (28.30%) and chicks (13.20%). Similar trends were reported by Sarba *et al.* (2019) [21] and Kika *et al.* (2023) [15], while contrasting findings were reported by Khatun *et al.* (2021) [14]. The higher prevalence in adults may result from prolonged pathogen exposure, production stress and age-related immune alterations.

Table I: Occurrence of APEC infections

No. of birds examined	No. of birds positive for <i>E. coli</i> infections	Occurrence (%)
447	53	11.85%

Table II: Occurrence of colibacillosis in different types of chicken

Type	Chick		Grower		Adult		Total	Percentage (%)
	No. of birds	Percent (%)	No. of birds	Percent (%)	No. of birds	Percent (%)		
Broiler	3	42.85	6	40.00	10	32.25	19	35.84
Layer	4	57.14	9	60.00	21	67.74	34	64.15
Total	7	100	15	100	31	100	53	100

Conclusion

The study revealed an occurrence of colibacillosis of 11.85% in the poultry examined, highlighting its ongoing importance as a major bacterial infection. Several pathological conditions such as perihepatitis, pericarditis, colisepticemia, egg peritonitis, salpingitis and omphalitis were observed, indicating the systemic involvement of the disease. Avian pathogenic *E. coli* isolates were confirmed using cultural and biochemical methods.

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