CASE REPORT

Sokoto Journal of Veterinary Sciences

(P-ISSN 1595-093X: E-ISSN 2315-6201)

http://dx.doi.org/10.4314/sokjvs.v23i3.7

Igbokwe *et al.*/*Sokoto Journal of Veterinary Sciences*, **23**(3): 194 - 198.

Egg yolk peritonitis in a 72-week-old commercial chicken layer flock

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Publication History:
Received: 18-02-2025
Revised: 09-06-2025
Accepted: 09-06-2025

Abstract

Egg yolk peritonitis (EYP) is an inflammation of the serosal surfaces of the abdomen of a hen because of yolk material deposition. EYP can be caused by poor formation of an egg, stressors or secondary bacterial infection. The symptoms of EYP include enlarged abdomen, cessation of egg production, reduced appetite and lethargy. A commercial poultry farmer in Maiduguri, Nigeria, experienced a significant rise in mortality and a steep decline in egg production over eight weeks in her 72-weeks flock comprising mainly of 2,096 ISA Brown, Shika Brown and a very few White Leghorn Hens. Mortality escalated to 220 birds (10.5%), while egg production plummeted from 62% to 20%, though the eggs remained of good quality. Dead birds exhibited a distinct yellowish, cheesy discharge from the cloaca, a key diagnostic clue for EYP. A post-mortem examination confirmed the presence of fibrinous exudates within the peritoneal cavity, along with yolk material adhering to abdominal organs. Microbiological culture identified *Escherichia coli* as the primary pathogen. Factors such as overcrowding, poor hygiene, and inadequate ventilation exacerbated the infection and facilitated pathogen proliferation. GenDoxCare® (Doxycycline and gentamycin sulphate), Vitalyte® (Glucose-based electrolytes, vitamins and amino acids) and Diclacox® (Diclazuril) were administered at recommended doses and management practices were improved. Egg production increased to 51% twenty-one days after treatment and continued to rise in subsequent days. It was concluded that the laying birds had egg yolk peritonitis caused by *Escherichia coli* which was resolved with medication and improved management practices.

Keywords: *Escherichia coli,* Egg yolk peritonitis, ISA Brown layers, Shika Brown layers, Maiduguri

Introduction

Inflammation of the serosal surfaces of the coelom cavities of a hen's reproductive tract caused by the deposition of yolk material is called egg yolk peritonitis (EYP). Among the pathogens implicated in the aetiology of EYP, *Escherichia coli* remains the most frequently isolated agent due to its ubiquitous presence in the poultry environment and its potential to invade compromised reproductive tracts (Li *et al.,* 2024).

The susceptibility of layers to EYP increases with age, as senescent hens experience reduced efficiency of reproductive and immune functions, making older flocks particularly vulnerable to this condition. In commercial layers, prolonged production cycles extending beyond 60 weeks can exacerbate these physiological vulnerabilities, heightening the risks of reproductive disorders, including yolk retention, follicular rupture, and subsequent peritonitis (Li *et al.,* 2024). Environmental and management stressors such as inadequate biosecurity, poor housing conditions, and suboptimal nutrition further predispose birds to *Escherichia coli* infections and other opportunistic bacterial invasions (Grace *et al.,* 2024; Poudel *et al.,* 2024).

Egg yolk peritonitis due to *Escherichia coli* often manifests with nonspecific clinical signs such as reduced feed intake, lethargy, and decreased egg production, making early detection challenging (Srinivasa *et al.,* 2013). Affected birds may show abdominal distension, depression, and cyanosis in severe cases, leading to sudden death if untreated (Li *et al.,* 2024). The pathogenesis of *Escherichia coli*-induced EYP involves bacterial colonization of the reproductive tract, facilitated by ascending infections from the cloaca or hematogenous dissemination (Watts & Wigley, 2024).

Plate I: Different breeds of layers in an cvercrowded space

Case Management

Case history

A commercial poultry farmer submitted seven carcasses of chickens to the Poultry Clinic of the University of Maiduguri Veterinary Teaching Hospital for postmortem examination with complaints of an alarming issue of unexplainable mortality in her flock of 72-weeks-old commercial layer hens, accompanied by a significant and progressive decline in egg production over eight weeks. Concurrently, egg production dropped precipitously from 62% to 20%, although the eggs produced remained of good size and quality. The initial mortality was sporadic but escalated to 220 cumulative deaths, representing a mortality rate of 10.5%. The farmer also observed yellowish, cheesy fluid exuding from the cloacal orifices of the dead birds, which showed no overt clinical signs of systemic illness. The birds were fed with Vital Layers® mash and clean drinking water *ad libitum* but she noticed they ate and drank less than usual. The flock is reared intensively on a deep litter system, consisting initially of 2,096 birds of mixed breeds (ISA Brown and Shika Brown) sourced from Zartech Farms, a reputable supplier of chicks in Nigeria. Farm records revealed drop in egg production and adequate vaccination schedule.

The flock had been treated with several medications before the onset of more severe clinical signs. The treatment choice aimed to address the birds' bacterial and nutritional needs. However, the effectiveness of the treatment regimen was limited, given the progressive nature of the disease. There were weak biosecurity measures in place at the farm. The stocking density exceeded the recommended levels for layers housed on deep litter (Plate I). ISA Brown, Shika Brown and White Leghorn breeds that have different physiological and immunological characteristics were housed together with poor hygiene and ventilation. Caked litter with a strong ammonia odour was also noted.

Clinical manifestation

The flock exhibited severe stress, with numerous birds huddling together in a corner of the pen. The affected birds displayed depression, with reduced activity, poor mobility, and general lethargy.

A few birds had swollen abdomens. The birds were reluctant to feed and drink water. The droppings from the affected

Plate II: Some of the carcasses submitted for postmortem

birds were brownish.

Investigations

Postmortem

The carcasses submitted were fresh, warm and found to be in fair to good condition (Plate II), with no signs of extreme emaciation. Swollen comb was observed in several dead birds. There was discharge from the cloaca which was semi-solid in consistency and had a distinct yellowish hue. The peritoneal cavity of the affected birds contained substantial amounts of foul-smelling yellowish yolk material (Plate III) that had adhered to the surfaces of the ovaries, intestines, and oviducts. The ovaries of affected birds were inflamed and distorted (Plate IV). There was marked congestion of the serosal vessels in the oviducts. In one of the birds, a fully shelled egg was lodged in the cloaca (Plate V).

Microbiology

Samples from various tissues, including the trachea, lung, heart, blood, liver, peritoneal exudate, oviduct, and cloaca, were cultured. The predominant isolate was *Escherichia coli*, found in pure culture. Environmental samples from the poultry house also yielded *Escherichia coli*. However, *Escherichia coli* was not found in the water or feed.

The isolated *Escherichia coli* strains were subjected to antimicrobial sensitivity testing (AST) using the Kirby-Bauer disc to know the appropriate treatment due to antimicrobial resistance reported in poultry. The highest zone of inhibition was around gentamycin when compared with ciprofloxacin, tetracycline and amoxicillin

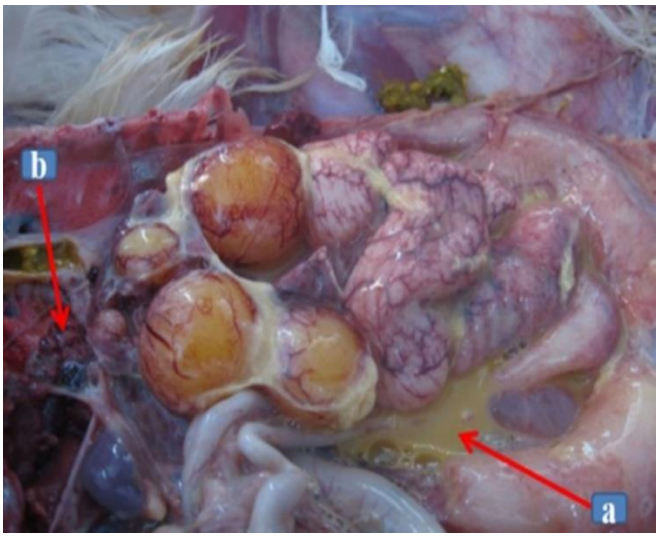

Plate III: Peritoneal cavity containing watery yolk material (a) with inflammatory changes in the ovary and oviduct (b)

Plate IV: Pedunculated ovaries with congested blood vessels (arrow)

Plate V: A fully shelled egg in the cloaca

indicating susceptibility of the organism to gentamycin.

Parasitology

No evidence of helminths was found in faecal samples, but Eimeria merozoites were seen in 4% of the intestinal samples.

The differential diagnosis was egg yolk peritonitis, egg drop syndrome or coccidiosis. The case was confirmed as egg yolk peritonitis caused by *Escherichia coli* with concurrent coccidiosis.

Management

Doxycycline hydrochloride and gentamycin sulfate (GenDoxCare®) water-soluble powder was administered as an antibiotic at 100g/200L of drinking water for five days. Vitalyte® (30 g/40 L of drinking water for five days) was administered to address dehydration and electrolyte imbalance. Diclacox® (Diclazuril) was administered as coccidiostat at 100 mL/200 L of drinking water for two days.

The client was advised to avoid mixing different breeds of chickens in the flock, reduce overcrowding, improve ventilation, control temperature and humidity and manage litter properly. Egg production increased to 51% twenty-one days after treatment and the percentage continued to rise gradually in subsequent days.

Discussion

Egg yolk peritonitis (EYP) is common in laying hens, often caused by bacterial infections following an ovulatory disturbance or reproductive tract injury. The primary causative agent of EYP in this case was identified as *Escherichia coli*. *Escherichia coli* infections in poultry are often secondary to reproductive tract trauma, immunosuppression, or environmental stress, leading to the leakage of egg yolk into the peritoneal cavity and subsequent inflammation (Kathayat *et al.,* 2021). A post-mortem examination revealed substantial yellowish yolk material in the peritoneal cavity, indicative of EYP. The congestion of the oviduct, and inflammation of the ovaries suggest the involvement of *Escherichia coli* in the pathogenesis of the condition. The large quantities of yolk material adhering to abdominal organs and the associated foul-smelling fluid are characteristics of bacterial infection-induced peritonitis. Egg yolk peritonitis is a well-documented complication of reproductive diseases in poultry (Namratha *et al.,* 2020).

The yellowish, cheesy fluid seen in the cloacal discharge of the dead birds and fibrinous exudates in the peritoneal cavity were consistent with the typical pathological findings of EYP. These observations and the detection of *Escherichia coli* in pure culture from multiple tissues confirmed the diagnosis of EYP. Previous studies have established that *Escherichia coli* is one of the most prevalent bacterial pathogens responsible for EYP, particularly in hens over 60 weeks of age, where reproductive failure becomes more common due to physiological changes and decreased immunity (Li *et al.,* 2024; Waliaula *et al.,* 2024).

The mixed-breed composition of the flock, comprising ISA Brown and Shika Brown hens, may have contributed to variations in immune responses. Breed-specific differences in immune competence have been documented in poultry, with some strains exhibiting heightened vulnerability to bacterial infections, including *Escherichia coli*-induced peritonitis (Kromann *et al.,* 2021). The inconsistent responses to stressors and pathogens in mixed-breed flocks could explain the varied disease progression and mortality observed in this case. The mortality recorded on the farm and the carcasses submitted were mostly Isa Brown chickens. Fayeye *et al.* (2017) reported that Shika Brown layers are resistant to many diseases affecting poultry in the tropics.

The caked litter, poor ventilation and weak biosecurity measures observed at the farm could have also provided a conducive environment for *Escherichia coli* to thrive.

In conclusion, the presence of yolk material within the abdominal cavity and isolation of *Escherichia coli* confirmed the diagnosis of EYP caused by *Escherichia coli* in commercial laying hens in Maiduguri. The condition was worsened by overcrowding and poor biosecurity, hygiene and ventilation. The medications administered and an improvement in management practices on the farm enhanced the recovery period of the birds.

Conflicts of interest

The authors declare no conflict of interest.

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