JOURNAL OF VETERINARY AND APPLIED SCIENCES
VOLUME 15, ISSUE 1: 969 – 979 (2025)
Published by: Faculty of Veterinary Medicine, University of Nigeria, Nsukka, Nigeria
ISSN: 2315-6856; e-ISSN: 2636-5553; Website: www.jvasonline.com

Concurrent ascariasis and coligranulomatosis (Hjärre and Wramby's disease) in a 42-week-old flock of exotic layer chickens: A case report

Jallailudeen R. Lawal [1, 4], Nanacha A. Igbokwe [2, 4], Fatima A. Lawan [3], Arhyel G. Balami [1, 4], Dauda L. Mohzo [5], Umar I. Ibrahim [1, 4], Yaqub A. Geidam [1, 4], Abdullahi A. Biu [6]

[1] Department of Veterinary Medicine, Faculty of Veterinary Medicine, University of Maiduguri, P.M.B. 1069, Maiduguri, Borno State, Nigeria.

[2] Department of Veterinary Physiology and Biochemistry, Faculty of Veterinary Medicine, University of Maiduguri, P.M.B. 1069, Maiduguri, Borno State, Nigeria.

[3] Department of Veterinary Microbiology, Faculty of Veterinary Medicine, University of Maiduguri, P.M.B. 1069, Maiduguri, Borno State, Nigeria.

[4] Postgraduate College of Veterinary Surgeons, Nigeria.

[5] Department of Veterinary Pathology, Faculty of Veterinary Medicine, University of Maiduguri, P.M.B. 1069, Maiduguri, Borno State, Nigeria.

[6] Department of Veterinary Parasitology and Entomology, Faculty of Veterinary Medicine, University of Maiduguri, P.M.B. 1069, Maiduguri, Borno State, Nigeria.

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Abstract

Concurrent ascariasis and coligranulomatosis was investigated in a 42-week-old flock of exotic layer chickens at a backyard poultry farm in Maiduguri, Borno State, Nigeria. On May 17, 2024, the farm reported a sudden rise in mortality, with a cumulative loss of 45 out of the 427 birds in the flock, over a period of eight weeks (10.5% overall mortality). Clinical signs included reduction in feed and water intake, decreased egg production by 20% and severe diarrhea. Affected birds exhibited lethargy, anorexia and respiratory distress, alongside pronounced weight loss and signs of dehydration. Necropsy revealed severe dehydration, distended intestines filled with viscous material, numerous adult *Ascaridia galli* in the intestinal lumen and the presence of granulomatous lesions on the intestinal wall and some internal organs. Additional findings at necropsy included necrotic foci in the liver and reproductive organs, alongside signs of pericarditis and pulmonary congestion. Bacteriological culture confirmed the presence of *E. coli*, and parasitological identification showed that the helminths were *Ascaridia galli*. Mycosis and tuberculosis were ruled out. Treatment with oxytetracycline and fenbedazole led to recovery. The interplay between these infections underscores the complex etiology of the outbreak, highlighting how parasitic infections can possibly compromise immune responses and predispose birds to bacterial diseases. This case emphasizes the need for integrated disease management strategies that address both parasitic and bacterial burdens in poultry to improve flock health and productivity.

Keywords: Ascariasis; Coligranulomatosis; *Ascaridia galli; Escherichia coli*; Layer chickens; Poultry health.

*** Correspondence:** Jallailudeen R. Lawal; Email: rabana4real@unimaid.edu.ng; Phone: +2348032886428

Article History: Initial manuscript submission received – Nov. 18, 2024; Final revised form received – April 25, 2025; Accepted for publication – April 30, 2025; Published – May 05, 2025.

Introduction

Coligranulomatosis, commonly referred to as Hjärre and Wramby's disease, is a significant chronic bacterial infection in poultry, caused predominantly by pathogenic strains of *Escherichia coli* (Landman and van Eck, 2017). *E. coli* is a versatile organism, which is part of the normal gut microbiota in birds, yet under certain predisposing conditions such as immunosuppression, poor environmental hygiene, or nutritional imbalances, it can become pathogenic and cause a variety of diseases in poultry, including coligranulomatosis (Yousef *et al*., 2023). First described by Hjarre and Wramby in 1945, coligranulomatosis is characterized by the formation of granulomatous lesions, primarily in the liver, intestines, mesentery, and caecal tonsils of affected birds (Trylich, 1966; Landman *et al*., 2019). These lesions result from chronic inflammatory reactions triggered by the immune system's response to the presence of *E. coli* bacteria, forming nodular masses that can impair normal organ function (Pokharel *et al*., 2023).

Ascariasis, caused by *Ascaridia galli*, is an important parasitic disease in poultry (Shifaw *et al*., 2021; Shohana *et al*., 2023). *Ascaridia galli* is a large intestinal nematode affecting a wide range of avian species, particularly chickens (Feyera *et al*., 2022; Ritu *et al*., 2024). This parasitic infection is most common in free-range and poorly managed intensive systems, where birds are exposed to contaminated environments (Shifaw *et al.,* 2021; Mlondo *et al*., 2022). Infected birds often show signs of lethargy, reduced growth, diarrhoea, and decreased egg production, particularly during heavy infestations *(*Sharma *et al*., 2018; Torres *et al*., 2019; Feyera *et al*., 2022*).* The presence of ascarid worms in the intestines can lead to inflammation of the intestinal mucosa, nutrient mal-absorption, and a weakened immune system, predisposing the birds to secondary infections with bacteria, such as *E. coli* (Dahl *et al*., 2002; Eigaard *et al*., 2006; Permin *et al*., 2006). Adult worms may also migrate into the oviduct, and become incorporated in eggs (Höglund *et al*., 2023). Heavy infection is the major cause of atrophy of the thigh and breast muscles, resulting in weight loss (Shohana *et al*., 2023).

The co-occurrence of ascariasis and coligranulomatosis is particularly a cause for concern in intensive poultry farming systems, where the stress of high stocking densities and suboptimal biosecurity measures may facilitate the interaction between parasitic and bacterial infections (Tsegaye and Miretie, 2021; Shohana *et al*., 2023; Ritu *et al*., 2024). The intestinal damage caused by *Ascaridia galli* can act as a predisposing factor for the colonization and proliferation of pathogenic *E. coli* in body tissues (Permin *et al*., 2006). This synergy between parasitic and bacterial infections can lead to more severe disease outcomes, including increased mortality, reduced egg production and overall compromised flock performance (Fathima *et al*., 2022; Shohana *et al*., 2023). High-density stocking, suboptimal biosecurity measures, and environmental factors such as poor ventilation and inadequate sanitation create conducive environment for both *Ascaridia* infestation and *E. coli* proliferation (Adebowale *et al*., 2022; Grace *et al*., 2024). In commercial poultry farming, the dual burden of ascariasis and coligranulomatosis poses a significant challenge, especially in layer flocks, where productivity is directly impacted through reduced egg production, increased morbidity and heightened mortality (Sharma *et al*., 2019).

The economic implications of these concurrent infections are profound. The poultry sector is a major contributor to the global protein supply, and diseases like ascariasis and coligranulomatosis can result in substantial financial losses due to decreased egg production, poor feed conversion efficiency and higher mortality rates. Birds infected with *Ascaridia galli* and subsequently developing coligranulomas often exhibit a marked decline in egg-laying capacity, further exacerbating the economic burden on commercial poultry systems (Permin *et al*., 2006; Grace *et al*., 2024).

Diagnosing these concurrent infections can be challenging. While the clinical signs of ascariasis such as weight loss, diarrhea and decreased feed conversion, are well-documented, the non-specific nature of the clinical signs of coligranulomatosis often overlap with other bacterial and viral infections, further complicating diagnosis (Ritu *et al*., 2024). Post-mortem examination of affected birds usually reveals granulomatous lesions in the liver, intestines and caecal tonsils, alongside the presence of *Ascaridia galli* in the intestines (Permin *et al*., 2006). The confirmation of coligranulomatosis requires bacteriological isolation of *E. coli* from the affected tissues, coupled with histopathological examination of the granulomas. Advanced diagnostic tools, such as polymerase chain reaction (PCR) and serotyping, may assist in the identification of the pathogenic *E. coli* strains responsible for the disease (Lutful Kabir *et al*., 2010; Ema *et al*., 2022; Pokharel *et al*., 2023).

The treatment and control of these concurrent infections is complex. Anthelmintics are commonly used to treat ascariasis, while antibiotics may be used for coligranulomatosis management. However, the growing concern over antimicrobial resistance in both veterinary and human medicine underscores the need for preventive strategies. Preventive measures should focus on stringent biosecurity protocols, regular deworming programs, improved housing conditions, optimal nutrition and the effective management of concurrent infections (Shalaby, 2013; Zirintunda *et al*., 2022).

This case report describes a clinical case of concurrent ascariasis and coligranulomatosis in a flock of 42-week-old exotic layer chickens in a poultry farm. The flock presented with clinical signs suggestive of a systemic infection, including decreased egg production, weight loss and increased mortality. Upon post-mortem examination, granulomatous lesions were observed in the liver, intestines and caecal tonsils, consistent with coligranulomatosis, along with the presence of *Ascaridia galli* in the intestines. This report provides an account of the gross pathological findings, diagnostic procedures, and therapeutic strategies employed in managing this case, while offering a comparative analysis with other documented outbreaks. By doing so, we hope to contribute to the growing body of literature on both coligranulomatosis and ascariasis, highlighting the importance of preventive management practices in minimizing the economic impact of these diseases on commercial poultry production.

Case Presentation

Case History: On May 17, 2024, a sudden rise in mortality was reported in a 42-week-old flock of exotic Isa brown layer chickens at a backyard poultry farm in Maiduguri, Borno State, Nigeria. The flock, consisting of 427 birds, was housed in an intensively managed deep litter system. The farm had been following established vaccination schedules against viral and bacterial pathogens, including Newcastle disease, Infectious bursal disease and Fowl cholera. Despite this, the farm had experienced sporadic deaths over the previous 8-week period, with a cumulative mortality rate of 10.5% (45 birds lost out of the total of 427 in the flock).

According to the farm attendant, the birds initially displayed a gradual decline in feed and water consumption. Within two weeks, this led to a significant drop in egg production, from an average of 120 eggs/day, to less than 100 eggs/day, a 20% reduction. Eggs from affected hens were noticeably smaller, with some of them showing poor shell quality –

thin, brittle, or malformed shells. At the same time, the birds began to exhibit severe diarrhoea, accompanied by a mild respiratory distress in some. The morbidity rate spiked, and affected birds were observed to exhibit progressive weight loss, lethargy, and general weakness.

During the onset of the disease, there was a sudden change in weather – a heat wave had increased ambient temperatures significantly, with day time temperatures reaching above 40°C, potentially exacerbating the birds' condition.

Clinical Signs: Affected birds displayed lethargy, anorexia and often huddled in the pen corners, showing signs of depression (Figure 1) and reluctance to move. Cloacal feathers were soiled (Figure 1), indicating diarrhea. Some birds exhibited mild respiratory distress with labored breathing, open-mouth breathing and occasional coughing, especially those showing dehydration and generalized weakness. Severely affected birds had pale combs and wattles (anaemia), emaciated bodies with prominent keel bones (wasting), and occasionally semi-solid cheesy material around the vent. Abdominal palpation revealed distended crops. The combs of some of the birds were cyanotic.

Physical Examination and Necropsy: Eight dead birds were examined. External findings included severe emaciation, prominent keel bones, soiled cloacal feathers (Figure 1), and signs of dehydration (poor skin elasticity, sunken eyes). Internally, the birds showed extensive pathological changes. The peritoneal cavity in some birds contained yellowish gelatinous exudate, indicating peritonitis. Numerous firm, grayish-white granulomatous nodules, characteristic of coligranuloma, were scattered across the intestines, mesentery, liver, and lungs (Figure 2). Nodules were 2 – 10 mm, with necrotic centres upon incision. The proventriculus and gizzard mucosa appeared congested with necrotic patches (Figure 3), suggesting secondary bacterial infection.

The heart was enlarged (Figure 4) and, in some cases, there was pericarditis, marked by a thickened pericardium and fibrinous exudate on the surface. There was congested and oedematous lungs in some cases, which manifested as red to purple discoloration. Reproductive organs, especially the left ovary, had granulomas similar to those in the liver and mesentery, with necrotic material in the reproductive tract.

The intestines exhibited necrosis, fibrinoid plaques and severe enteritis, with partially digested feed mixed with necrotic debris. The gizzard's koilin layer showed ulceration, compromising gastrointestinal integrity. *Ascaridia galli* was recovered from the intestine of some of the birds that were necropsied (Figure 5).

Figure 1. Clinical signs observed in layers with concurrent ascariasis and coligranulomatosis: (**a**) – Sick birds with soiled vent; (**b**) – Depression in some of the sick birds.

Figure 2. Lesions of coligranulomatosis in the layer chickens: Large numbers of grayish-whitish nodules on surface of the intestine **(a)** and in the liver **(b)**.

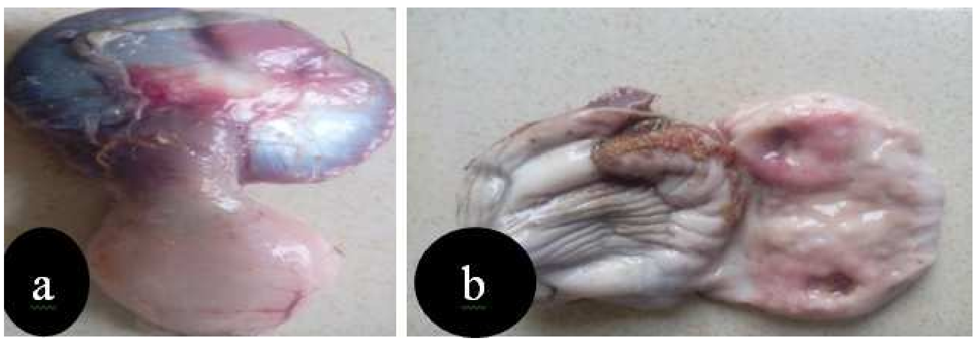

Figure 3. Further lesions observed at necropsy of the layer chickens with ascariasis and coligranulomatosis: **(a)** – Swollen gizzard and proventriculus; **(b)** – Areas of inflammation and necrosis in the gizzard.

Figure 4. Enlarged heart of layer chicken with ascariasis and coligranulomatosis.

Figure 5. *Ascaridia galli* recovered from the intestine of some of the birds that were necropsied.

Initial and Differential Diagnosis: Observed signs and lesions suggested tentative diagnoses of coligranulomatosis, commonly associated with *Escherichia coli* infections and ascariasis caused by *Ascaridia galli*. Other potential conditions considered in the differential diagnosis were mycotic granulomatosis, avian tuberculosis and colibacillosis.

Confirmatory Diagnosis: Faecal flotation confirmed *Ascaridia galli* eggs. Intestinal examination during necropsy revealed a heavy worm burden. *E. coli* was isolated from granulomatous lesions in tissues. Biochemical tests and serotyping identified it as avian pathogenic *E. coli* (APEC). Antibiotic susceptibility testing indicated multidrug resistance, with sensitivity to fluoroquinolones and cephalosporins. Combined parasitological, serotyping and bacteriological findings confirmed a diagnosis of concurrent *Ascaridia galli* infection and coligranulomatosis.

Treatment: Upon confirmatory diagnosis of concurrent *Ascaridia galli* infection (ascariasis) and coligranulomatosis (Hjärre's and Wramby's Disease) in the chickens, a targeted therapeutic regimen was instituted. The treatment approach aimed to address both the parasitic and bacterial infections identified.

Antibiotic Therapy: The birds were treated with Oxytetracycline hydrochloride (Tetracin®, Global Organics Ltd., Kano, Nigeria), a broad-spectrum antibiotic. The drug was administered via drinking water at a dosage of 1 g per litre of water for 5 consecutive days.

Anthelmintic Therapy: For the treatment of ascariasis, the flock was dewormed with 10% Fenbendazole suspension (Panacur®, MSD Animal Health, SA), a benzimidazole-class anthelmintic with proven efficacy against *Ascaridia galli*. The drug was administered orally at a dosage of 1 ml per 2 litres of water for one day**.**

Outcome of Treatment: Upon treatment, the flock showed significant clinical improvement within one week of initiating treatment. There was a marked reduction in mortality and morbidity, with normalization of feed consumption, activity levels and egg production. No recurrence of gross lesions or clinical signs associated with either disease condition was observed in the subsequent four weeks post-treatment (Figure 6). Follow-up fecal examinations and post-treatment monitoring indicated successful elimination of *Ascaridia galli* eggs.

Figure 6. Recovery of the layer flock affected by ascariasis and coligranulomatosis, after treatment with oxyteracycline and fenbendazole.

Discussion

This case report of concurrent ascariasis and coligranulomatosis (Hjarre's Disease) in a 42-week-old flock of exotic layer chickens underscores the complex interplay between parasitic and bacterial infections in poultry production systems. The cumulative mortality rate of 10.5% recorded in this flock emphasizes the severe consequences of the dual infections on flock health and productivity, as well as the multi-factorial challenges in managing poultry diseases. These findings corroborate previous research, such as the studies by Landman and van Eck (2017) and Liebhart and Hess (2018), which reported coligranulomatosis as a significant bacterial disease in poultry flocks, while *A. galli* has been reported to impair the humoral immune responses (HIRs) following vaccination against other pathogens (Pleidrup *et al*., 2014)

Simultaneous parasitic and bacterial infections have been documented to intensify pathological outcomes, a pattern observed in this case. Permin *et al*. (2006), Höglund *et al*. (2023) and Shohana *et al*. (2023) earlier reported heightened virulence and mortality rates in experimental infections involving *Ascaridia galli* and *Escherichia coli*. Similarly, Dahl *et al*. (2002) observed that parasitic infections, such as those caused by *A. galli*, can predispose chickens to co-infections with bacterial pathogens. These studies highlight how parasitism can alter gut microbial ecology, leading to increased bacterial colonization and infection severity. Conversely, findings by Sharma *et al*. (2019) suggest that *A. galli* may inhibit normal gut microbiota, further illustrating the complex effects of parasitic infections on intestinal microbial dynamics.

The co-occurrence of *A. galli* and *E. coli* in this flock led to severe granulomatous inflammation in multiple organs, indicative of a chronic disease process. *A. galli* impairs nutrient absorption and induces immunosuppression, creating an environment conducive to opportunistic infections. *E. coli*, a ubiquitous gut inhabitant, probably exploited the compromised immune defenses to establish systemic infection. These findings align with observations from Wang and Liu (2022), who described granulomas in the intestines and reproductive organs as hallmarks of systemic bacterial dissemination.

It is thought that environmental stressors, particularly the heat wave with temperatures exceeding 40°C, compounded the health challenges in this flock. Also, poor housing conditions, including overcrowding and malfunctioning feeding and watering systems may have exacerbated the stress and further compromised the birds' immune systems. Stress is a known precipitating factor for poultry diseases, as highlighted by Hofmann *et al*. (2020), Akinyemi and Adewole (2021) and Apalowo *et al*. (2024), who linked environmental stress to immune suppression in commercial chickens. The role of environmental management in mitigating stress-induced immunosuppression cannot be overstated, as practices such as ensuring proper ventilation and maintaining optimal stocking densities are critical to disease prevention.

The observed 20% reduction in egg production and the production of smaller, poorly formed eggs underscore the economic implications of such outbreaks. Coligranulomatosis-associated systemic infection in reproductive organs, including the ovaries, as noted in this case, could lead to long-term reproductive inefficiencies, consistent with findings by Joseph *et al*. (2023). This, not only affects flock productivity, but also has profound economic implications for poultry operations.

The isolation of a multi-drug-resistant *E. coli* strain in this flock highlights a growing challenge in disease management. Antimicrobial resistance (AMR) complicates treatment options and raises significant public health concerns, as resistant strains can be transmitted between animal and human populations (Abreu *et al*., 2023; Salam *et al*., 2023; Agusi *et al*., 2024; Matope *et al*., 2024). Studies by Pinto Ferreira *et al*. (2022) and Shahi and Jeamsripong (2024) emphasize the importance of prudent antibiotic use and robust antimicrobial stewardship in poultry production to mitigate AMR risks.

To manage the complexities of concurrent infections such as the one described in this report, an integrated approach is essential. Regular flock monitoring, routine deworming and stringent biosecurity measures are critical to limiting pathogen introduction and spread. Enhanced farmer education on early disease recognition and timely interventions is also imperative. Necropsy and faecal examinations can serve as invaluable tools for early detection of parasitic and bacterial infections, which will facilitate prompt therapeutic interventions. This present reported case underscores the importance of adopting comprehensive management strategies, including stress reduction, routine parasite control and antimicrobial stewardship, to preserve poultry health and productivity. Such approaches are indispensable for mitigating the impact of complex disease interactions in poultry flocks.

Conclusion: The findings from this case report highlight the critical implications of concurrent ascariasis and coligranulomatosis in a flock of exotic layer chickens, which resulted in a cumulative mortality rate of 10.5%. The complex interplay between parasitic and bacterial infections in this case underscores the importance of understanding the multi-factorial nature of poultry diseases.

Recommendations: To manage concurrent ascariasis and coligranulomatosis effectively, an integrated health management approach should be implemented. This includes regular health assessments of the flock by veterinary professionals, routine monitoring for early signs of infection and strict biosecurity measures. A deworming program based on fecal examinations is recommended to control *Ascaridia galli*, combined with the strategic use of anthelmintics. Enhancing biosecurity by restricting access to poultry areas, maintaining proper sanitation, and controlling environmental factors like temperature and crowding can reduce stress and lower infection risks.

Additionally, proper nutrition, tailored to support immune resilience during stress, is essential. Providing balanced feed rich in necessary vitamins and minerals can bolster bird health and productivity. Improving housing conditions with adequate ventilation, reduced stocking density, and consistent access to feed and drinking water can also enhance the flock's resistance to infections. Training farm personnel on disease recognition and management practices, along with fostering a culture of ongoing research and disease surveillance, can help prevent future outbreaks and support sustainable poultry farming.

Conflicts of interest

The authors declare that they have no competing interests.

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