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Systemic fowl typhoid caused by *Salmonella gallinarum* in broiler chickens: Pathological and microbiological evidence

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ABSTRACT: *Salmonella gallinarum*, the causative agent of fowl typhoid, is a highly pathogenic bacterial disease associated with substantial mortality in poultry, predominantly affecting adult chickens and turkeys. This study aimed to describe the pathological lesions and microbiological characteristics of *S. gallinarum* infection in chickens with fowl typhoid. *S. gallinarum* is a gram-negative, rod-shaped, facultative anaerobic bacterium with an optimal growth temperature of 37 °C and the ability to survive across a broad pH range (4.0–9.0). Necropsy findings in affected chickens revealed interstitial pneumonia of the lungs, intestinal hyperemia with petechial hemorrhages, hepatomegaly, splenomegaly, and fatty degeneration of the cardiac tissue. Bacterial culture of intestinal swab samples on MacConkey agar demonstrated the growth of pale-yellow colonies consistent with *S. gallinarum*. Microscopic examination confirmed Gram-negative bacilli, while biochemical testing showed an alkaline/acid reaction, absence of gas and H_2S production, non-motility, and negative indole and urease reactions.

Keywords:
Salmonella gallinarum, fowl typhoid, poultry, necropsy findings, bacterial isolation

■ INTRODUCTION

Salmonella gallinarum infection causes fowl typhoid, a systemic disease with high mortality rates in poultry. The disease affects adult and growing chickens and turkeys, and other avian species, including ducks, guinea fowl, peafowl, teals, and quails, may be susceptible (Swayne 2020). Transmission occurs through the ingestion of contaminated food and water. Salmonellosis in poultry is a major economic concern because of inefficient control strategies and conditions that favor microbial growth. *S. gallinarum* infections cause substantial economic losses in the poultry industry (Nirmala *et al*. 2018).

The clinical manifestations of fowl typhoid vary according to the stage of infection. Subacute infections cause embryonic mortality, whereas acute infections lead to septicemia. In chronic cases, chickens show anemia and focal necrosis of vital organs, including the liver, heart, intestine, and pancreas. *S. gallinarum* shows lower cecal colonization than paratyphoid Salmonella serotypes. Its invasive potential is enhanced by the absence of immunogenic flagella, allowing evasion of host inflammatory responses and facilitating chronic infections with minimal signs (Swayne 2020).

Despite the well-documented pathogenicity of *S. gallinarum*, correlations between gross pathological findings and microbiological characteristics in naturally infected chickens remain limited in the field. Diagnosis often relies solely on clinical presentation without comprehensive necropsy and bacteriological analyses, which may hinder accurate diagnosis and delay treatment initiation in affected animals. This study aimed to describe the pathological lesions and microbiological characteristics of *S. gallinarum* infection in chickens with fowl typhoid, contributing to improved diagnostic and disease management strategies in poultry.

■ CASE

Anamnesis and Signalment: The chickens subjected to necropsy originated from a commercial broiler farm in Jatinangor, Indonesia. The samples consisted of three 30-day-old broiler chickens in the finisher phase, comprising one clinically healthy bird and two birds with clinical signs. According to the anamnesis and clinical observations, the affected chickens showed generalized weakness and lethargy, dull and ruffled feathers, greenish watery diarrhea accompanied by mucus, frequent recumbency with a tendency to remain close to the heat source, and body weights below the expected standard for their ages.

Necropsy Procedure: Necropsy was conducted following standard veterinary pathological procedures. A thorough gross examination of the external body surface and internal organs was performed, including the respiratory, cardiovascular, digestive, hepatobiliary, and lymphoid systems.

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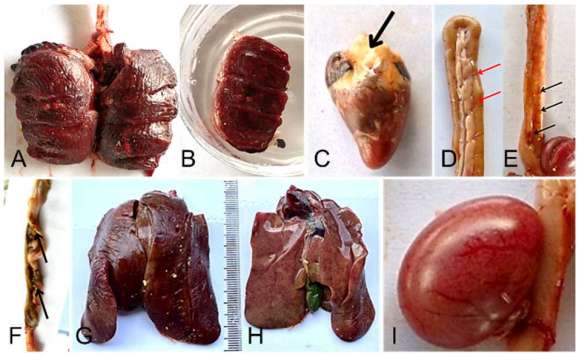

Figure 1. Gross pathological findings in the organs of chickens infected with fowl typhoid. (A) Interstitial pneumonia in lungs, (B) lung flotation test, (C) fatty degeneration of the heart, (D) duodenal congestion with petechial hemorrhages, (E) petechial hemorrhages in the jejunum, (F) petechial hemorrhages in the cecum, (G) hepatomegaly (dorsal view), (H) hepatomegaly (ventral view), and (I) splenomegaly. Red arrows indicate congestion; black arrows indicate petechial hemorrhages.

Microbiological and Biochemical Identification: Microbiological examination was performed using bacterial culture on MacConkey agar (MCA), followed by standard biochemical testing, including citrate, Kligler Iron Agar (KIA), and MIU assays, to characterize the phenotypic and metabolic properties of the isolate and confirm the identification of *S. gallinarum*.

■ RESULTS AND DISCUSSION

Based on the necropsy findings, pathological alterations were observed in the lungs, intestines, liver, spleen, and heart (Figure 1). These lesions indicate systemic involvement, which is consistent with salmonellosis. *Salmonella* spp. replicate within macrophages and disseminate to the mesenteric lymph nodes, leading to bacteremia and invasion of systemic organs, particularly the liver. Hepatobiliary pathology revealed hepatomegaly, as evidenced by hepatic apex adhesion. Hepatomegaly in infected chickens results from granulomatous inflammation and hepatocellular necrosis induced by the bacteria. Intestinal hemorrhage is associated with damage to the mucosal lining, which is a hallmark of salmonellosis. Salmonella invades intestinal epithelial cells, triggering inflammation, ulceration, and vasculitis, resulting in hemorrhage (Shaji *et al*. 2023). These findings support the systemic and enteric pathogenic nature of *S. gallinarum* infection in poultry.

This case study has some limitations. Histopathological examination was not performed, precluding confirmation of tissue damage at the cellular level. Antimicrobial susceptibility testing was not performed, preventing laboratory-based recommendations for antibiotic therapy. However, the macroscopic pathological findings, particularly hepatomegaly and intestinal hemorrhage, were consistent with previously reported salmonellosis cases that included histopathological analyses. Devi *et al*. (2025) demonstrated in broiler chickens that such macroscopic lesions correlated with severe microscopic tissue damage. Bacterial isolation was performed under aseptic conditions; however, molecular confirmation using polymerase chain reaction (PCR) was not performed.

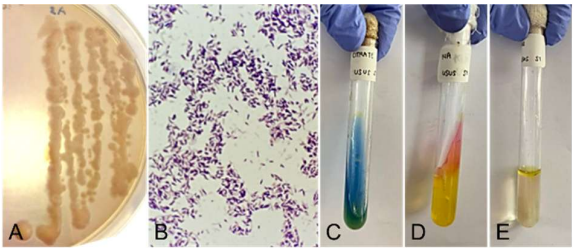

Figure 2. Isolation and identification of bacteria from the intestinal organs of chickens. (A) Pale yellow colonies on MacConkey agar, (B) Gram-negative bacilli, (C) biochemical reactions showing citrate-negative, K/A on Kligler Iron Agar with no gas and no H_2S production, (D) urease-negative, (E) indole-negative, and non-motile results.

Microbiological examination revealed pale yellow colonies on MacConkey agar (Figure 2). Biochemical testing showed a negative citrate reaction, an alkaline/acid reaction on Kligler Iron Agar (KIA) without gas or H_2S production, and negative indole and urease reactions on MIU medium. These characteristics are indicative of *S. gallinarum*, a gram-negative, non-motile, rod-shaped bacterium, facultatively anaerobic, grows optimally at 37 °C, and survives at pH 4.0–9.0. On agar media, the colonies appear round, smooth, and slightly raised. *S. gallinarum* ferments glucose without gas production and does not decarboxylate ornithine or produce indole, urease, or gelatinase. Unlike motile paratyphoid Salmonella serotypes, *S. gallinarum* is less resistant to heat and disinfectants but can persist in moist organic environments, facilitating transmission within poultry populations (Swayne 2020, McVey *et al*. 2022).

■ CONCLUSION

Clinical signs, gross pathological lesions, and microbiological findings confirmed *Salmonella gallinarum* as the cause of fowl typhoid in this broiler case, demonstrating the value of necropsy and bacteriological examination in poultry.

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