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(Research Article)

Prevalence of Multidrug-Resistant *Escherichia coli* O157:H7 in Poultry Faeces from Live Bird Markets in Lagos, Nigeria

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Abstract

Escherichia coli (*E. coli*), a gram-negative bacterium, is a major concern for human and animal health. While most *E. coli* strains are commensal, some can become dangerous pathogens causing intestinal and systemic illnesses. Poultry meat is a potential source of infection; as resistant *E. coli* can be transmitted to humans through the food chain. This study aimed to determine the prevalence and antibiotic resistance patterns of *E. coli* O157:H7 in poultry faeces from a live bird market in Lagos, Nigeria.

Samples were enriched in TSB (9 mL) at 37 °C for 18–24 h, plated onto EMB and SMAC agar, and presumptive *E. coli* O157 isolates (non-sorbitol fermenters) were confirmed by latex agglutination, following the manufacturer's instructions. Antimicrobial susceptibility testing was performed on confirmed *E. coli* O157 isolates using the Kirby-Bauer disc diffusion method.

A total of 180 poultry fecal samples were analyzed. Out of these, 105 (58.33%) were identified as *Escherichia coli* isolates. The isolation process further revealed that 74 (41.11%) of the isolates were non-sorbitol fermenters, and 26 (14.44%) were confirmed as *Escherichia coli* O157:H7 using the latex agglutination test._The isolates showed high resistance to most of the tested antibiotics. The findings indicate a high prevalence and a high level of multidrug resistance in *E. coli* O157:H7 from indigenous chickens in Lagos' live bird markets. The presence of these pathogenic and resistant organisms poses a significant public health risk to individuals with direct contact with the birds and to consumers in Nigeria.

Keywords: *Escherichia Coli* O157:H7; Poultry Faeces; Live Birds; Antibiotic Resistance; Public Health

1. Introduction

Microbial foodborne illness remains a significant global concern despite extensive scientific and technological advancements. This is particularly true in developing countries, especially in Africa, where poor food handling practices,

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inadequate food safety laws, and a lack of education for food handlers are prevalent (Haileselassie *et al*., 2013; Ekpunobi *et al*., 2024a).

Escherichia coli (*E. coli*), a gram-negative bacterium which has a significant impact on human and animal health. Most *E. coli* reside in the large intestine as commensals but can become a dangerous pathogen that promotes intestinal and systemic illnesses under various conditions (Kittana *et al*., 2018; Chukwunwejim *et al*., 2025). One of the most significant foodborne pathogens that has received increased attention in recent years is *E. coli* O157:H7. This enterohemorrhagic strain can cause life-threatening illnesses such as hemorrhagic colitis and hemolytic-uremic syndrome (HUS).

The emergence of antimicrobial resistance (AMR) is a major problem in both human and veterinary medicine. Antimicrobial agents are routinely administered to poultry as antimicrobial growth promoters (AMGP), and the indiscriminate use of these antimicrobials for both therapeutic and preventive purposes could increase the risk of resistance (Hassan, 2021; Obidi and Ekpunobi, 2025). Development of resistance to antimicrobial is a complex phenomenon that involves bacterial genetic and metabolic mechanisms, and it can be expedited due to antibiotic selection pressure (Zhang *et al*., 2015; Munita and Arias, 2016; Ekpunobi *et al*, 2025). Due to intensive production, the antibiotic selection pressure for resistance in microorganisms is high, and consequently, their faecal flora contains a comparatively high proportion of resistant microorganisms (van den Bogaard and Stobberingh, 2001; Hassan *et al*., 2021). Those resistant organisms can transmit into human, animals, and the environment (McEwen and Collignon, 2018; Obidi *et al*., 2025).

Poultry meat serves as a potential source of human infection, as there is a high chance of contamination with *E. coli* during food preparation. Studies have shown that broiler meat can contain antimicrobial-resistant *coli*, which can be transmitted to people through the food chain, representing a possible risk of human infections (Suswati *et al*., 2025). In Nigeria, where unsanitary conditions and poor health facilities are widespread, there is an urgent need to study this emerging pathogen and its characteristics to reduce human health hazards. The lack of rigorous surveillance for food pathogens presents a challenge in demonstrating the magnitude of contamination with *E. coli* O157:H7 in the poultry industry. This study aims to generate data to address this gap.

2. Materials and methods

2.1. Sample Collection

Poultry faeces samples were obtained from the Poultry Market in Alaba Market, Lagos State. Aseptic techniques were used to collect fresh chicken faeces in sterile 10 ml test tubes containing sterile buffered saline water, which served as a pre-enrichment medium. The samples were transported to the laboratory in a transport bag within one hour for prompt analysis.

2.2. Microbiological Isolation and Identification

Samples were pre-enriched in 9 ml of Tryptic Soy Broth (TSB) and incubated at 37°C for 24 hours. After incubation, 0.1 ml of the pre-enrichment broth was inoculated onto prepared plates of Eosin Methylene Blue (EMB) agar and incubated at 37°C for 24 hours. Medium-sized colonies exhibiting a green metallic sheen were considered to be *E. coli* and sub-cultured onto Sorbitol MacConkey (SMAC) agar (Oxoid, UK). Colorless colonies (non-sorbitol fermenters) were purified by sub-culturing, twice onto fresh SMAC agar and were considered presumptive *E. coli* O157. The serogroup O157 of *E. coli* was determined using a latex agglutination test kit (*E. coli* O157 latex test, Oxoid®, UK) as described by the manufacturer.

2.3. Antimicrobial Susceptibility Testing

The confirmed *coli* O157 isolates were tested for their susceptibility to antimicrobial agents using the agar disc diffusion method, following CLSI guidelines. The following commercially available Gram-negative antibiotic discs were used: ceftazidime (30 µg), cefuroxime (30 µg), gentamicin (10 µg), cefixime (5 µg), ofloxacin (5 µg), amoxicillin (30 µg), nitrofurantoin (5 µg), ciprofloxacin (30 µg).

The antibiotic discs were placed on Mueller Hinton agar plates previously seeded with an overnight culture of the test organisms. The plates were incubated at 37°C for 24 hours, after which the zones of inhibition were measured and interpreted.

3. Results and discussion

A total of 180 poultry fecal samples were analyzed. Out of these, 105 (58.33%) were identified as *Escherichia coli* isolates. The isolation process further revealed that 74 (41.11%) of the isolates were non-sorbitol fermenters, and 26 (14.44%) were confirmed as *Escherichia coli* O157:H7 using the latex agglutination test. The prevalence of *E. coli* O157:H7 in this study, at (26/180) 14.44%, is quite similar to previously reported findings in Lagos and Ogun state, Nigeria (Aibinu *et al*., 2007; Olatoye *et al.*, 2012). The study reported a slightly higher prevalence than reports from Ethiopia (13.4%) (Shecho *et al*., 2017). The variations in prevalence may be due to differences in sampling techniques, geographical areas, and a lack of strict hygiene measures. The high occurrence in indigenous chickens from live bird markets might be explained by the high concentration and interaction of diverse birds from different sources.

The public health implication of the high prevalence of *E. coli* O157:H7 in indigenous chickens in live bird markets is that, the presence of these pathogenic organisms puts live bird sellers and intermediaries at risk of occupational hazards. Furthermore, pathogenic *E. coli* from the gut can contaminate chicken meat, posing serious public health problems, including zoonotic transfer to human consumers (Odo *et al*., 2021; Chukwunwejim *et al*., 2025).

The antimicrobial susceptibility pattern observed among the 26 *E. coli* O157 isolates demonstrates an alarming level of multidrug resistance (MDR), with nearly all isolates resistant to third-generation cephalosporins (cefixime, cefotaxime, ceftriaxone), aminopenicillins (amoxiclav), and first-line fluoroquinolones (nalidixic acid, ofloxacin).

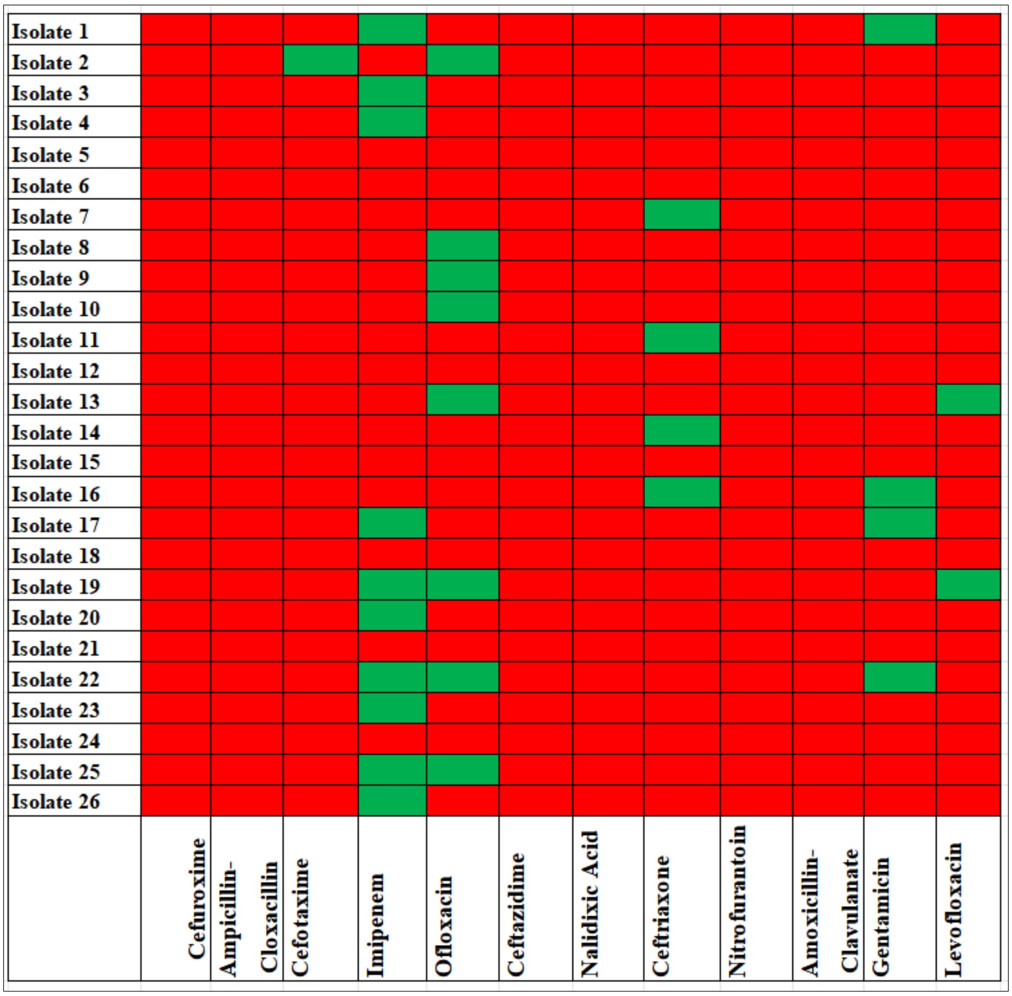

Figure 1 Heat map representing antimicrobial susceptibility/resistance in 26 *E. coli* O157:H7 isolates. The Green color in heat map indicates antibiotic sensitivity and red color indicates antibiotic resistance in the 26 isolates

This finding is consistent with previous reports from Sub-Saharan Africa, where the widespread and often unregulated use of broad-spectrum antibiotics in both human and veterinary practice has driven the rapid emergence of resistant Enterobacteriaceae (Odonkor and Addo, 2018; Ekpunobi and Agu, 2024).

A key observation in this dataset is the near-universal resistance to extended-spectrum cephalosporins (CXM, CTX, CRO), suggesting the potential involvement of extended-spectrum β-lactamase (ESBL) production, which is now increasingly reported in *E. coli* O157 and other diarrheagenic pathotypes (Paterson and Bonomo, 2005; Ezemba *et al.*, 2022; Ekpunobi *et al.*, 2024b). The resistance to cephalosporins, coupled with high resistance to aminopenicillins (AUG), leaves very limited therapeutic options for empirical treatment in resource-limited settings such as Nigeria.

Interestingly, imipenem (a carbapenem) retained moderate activity, with approximately 40% of isolates remaining susceptible. This aligns with global surveillance reports that carbapenems often remain the "last line" against MDR *E. coli*. However, the reduced susceptibility even to imipenem in more than half the isolates is a serious public health concern, raising the possibility of emerging carbapenemase-producing Enterobacteriaceae (CPE) within the region.

Gentamicin and lomefloxacin demonstrated low but noteworthy activity, with 15–20% susceptibility rates. While this suggests some residual therapeutic potential, their limited efficacy means they cannot be relied upon for routine management. The low susceptibility rates further emphasize the multidrug-resistant nature of these isolates, where resistance spans at least three or more antibiotic classes, fulfilling the definition of MDR.

The clinical and epidemiological implications are profound. Infections with MDR *E. coli* O157 are not only difficult to treat but also carry risks of outbreaks due to food and water contamination, especially in settings where routine laboratory confirmation and surveillance are weak. For Nigeria, this underscores the urgent need for enhanced surveillance systemto detect ESBL- and carbapenemase-producing strains early, strengthening laboratory capacity and antimicrobial stewardship programs to regulate inappropriate antibiotic use in hospitals, communities, and animal husbandry.

4. Conclusion

In conclusion, this study found a high prevalence and a significant level of multidrug resistance in *E. coli* O157:H7 from poultry faeces in a Lagos live bird market. The data presented here reveal a disturbing trend of escalating resistance, mirroring global concerns about a looming post-antibiotic era. Without urgent containment measures, infections caused by *E. coli* O157 in Nigeria could become untreatable with conventional antibiotics, compounding morbidity and mortality rates.These findings highlight a substantial public health threat to both those who work with the birds and consumers. There is an urgent need for effective surveillance and control measures to combat the spread of these pathogens and to regulate the use of antimicrobials in the poultry industry.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of Ethical Approval

Ethical review and approval were not required for this study on poultry feces, as it did not involve human participants or live vertebrate animals and was conducted in compliance with institutional and national guidelines.

Statement of Informed Consent

Informed consent was not applicable to this study as no human participants were involved.

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