Article Summary

The article involved 65 samples of chicken, luncheon, and hamburger, and cattle feces from Nagazig City, Al-Sharkia, Egypt, to identify multidrug-resistant Shiga toxin-producing *Escherichia coli* (O157:H7 serotype). The researchers used the "Most Probable Number" method, EMB agar, and CT-SMAC medium to identify ten suspected E. coli O157 strains from cattle feces. The susceptibility of antibiotics explained that eight isolates were multidrug-resistant. They demonstrate 100% resistance to amoxicillin or clavulanic acid, cefoxitin, polymyxin B, ceftazidime, erythromycin, and piperacillin. Two exceptions of O157:H7 have been serologically tested (CF8 and CF13) and possessed major virulence genes (CF8 stx2 and CF13 stx2, stx1, and stx2). Molecular identification using partial 16S rRNA sequencing proved the epidemiological confirmation of these isolates and they identified that 98-100% of their isolates were related to known pathogenic E. coli strains (Nada et al., 2023). Based on the results, the authors provide the significance of increasing surveillance, controlling the use of antibiotics on animals, and treatment and disposition of animal waste to minimize the spread of MDR STEC strains. As the research notes, the cattle feces are the major center of MDR STEC in the region, which constitutes a high-risk "One Health Hazard" due to the surroundings affect and the potential risk of infection in humans through food poisoning, water pollution, and direct contact.

Pathogen Information

Morphology and Cellular Characteristics

Escherichia coli is a rod-shaped, gram-negative live bacterium, and a facultative anaerobe that belongs to the family of *Enterobacteriaceae*. They have peritrichous flagella, which aid in their movement, and surface antigens (O, H, and occasionally K), which are utilized in serotyping (Cowan & Smith, 2021). Their pathogenicity is associated with factors plasmid-encoded, the LEE pathogenicity island, and Shiga toxin-coding bacteriophages.

Susceptibility to Antimicrobials

According to recent research, E. coli have an increasing sentiment of multidrug resistance, especially against β-lactams, macrolides, and polymyxins because of mobile resistance genes (Rahimzadeh et al., 2024). For this bacterium, antibiotics do not show clinical effectiveness because carbapenems, aminoglycosides, and fluoroquinolones tend to have an active effect when treatment with antibiotics takes place. Reports of the surveillance kept pointing to ESBL-producing STEC strains in food and animals.

Host Cells, Nutritional Needs, and Growth Conditions

E.coli infect intestinal epithelial cells and attack microfold (M) cells and enterocytes located on the intestine, where they cause attaching-and-effacing lesions. They flourish best at 37℃, they are facultative anaerobes, and simple nutrients, including glucose and amino acids, are required, and they have been cultured successfully in enriched media and in the nutrient-rich lumen of the intestine (Tuttle et al., 2021). The acid resistance mechanism increases their survival ability as it enables them to pass through the stomach.

Mode of Invasion into the Host(S) and How It Evades the Immune System

E. coli enters intestinal cells through intimin-Tir interactions and injects effector proteins into the cell through the type III secretion system. Shiga toxins (Stx1/Stx2) get into the host cells through binding with Gb3 receptors, inhibition of ribosomal protein synthesis, and apoptosis with a suppressed immune response (Rahimzadeh et al., 2024). Additional support to immune evasion is provided by biofilm formation, antioxidant defenses, and phage-mediated toxin regulation.

Interactions with the Hosts, Diseases Caused, and Body Systems That Are Affected

This pathogen mainly targets the gastrointestinal tract, resulting in damage to the mucosa, inflammation, and the spread of systemic toxins (Tuttle et al., 2021). It may enter the bloodstream, impair the renal microvasculature, causing hemolytic uremic syndrome (HUS), and can impact the CNS by causing damage to endothelial cells. The bacteria cause a severe innate response, cytokine storm, and neutrophil activation.

Symptoms When the Pathogen Infects a Host

There are clinical symptoms that start with abdominal cramps, watery diarrhea, and vomiting, which progress to bloody diarrhea in 2-3 days. Severe cases progress into HUS, which is marked by hemolytic anemia, thrombocytopenia, and acute kidney damage, with a tendency in children and older adults (Cowan & Smith, 2021).

Diagnosis and Therapeutic Intervention Needed

Diagnosis is based on stool culture and the use of PCR to detect stx1, stx2, and O157-specific genes and enzyme immunoprecipitation to detect Shiga toxins (Nada et al., 2023). The therapy is mostly supportive, with fluid and renal complication advancement supervision focus; antibiotics and antimotility drugs are not used as they increase HUS risks. Severe cases of the human Uremic syndrome can demand dialysis, red blood cell transfusion, and intensive care, and there is emerging evidence on complement inhibitors such as eculizumab.

Modes of Disease Transmission

This bacterium is mainly spread through a fecal-oral pathway, and it is caused by contaminated beef, raw milk, leafy vegetables, and water contaminated with animal feces. The person-to-person transmission is quite easy and is common in childcare facilities because of a low infectious dose of less than 100 organisms. The transmission between cattle, the primary reservoir, causes significant outbreaks worldwide through direct contact with the animals or indirectly by contaminating the environment.

Strategies to Prevent the Disease

Techniques of food safety prevention include interventions, like cooking ground meat to ≥160℉ (71℃), unpasteurized dairy, and cross-contamination prevention in food preparation areas (Centers for Disease Control and Prevention, 2025). The prevention of cattle hygiene information, manure treatment, enhanced quality of irrigation water, and regular monitoring of food-processing facilities are all considered to be a part of the public health measures. The transmission is also decreased by hand hygiene, safe childcare, and keeping the symptomatic out of the high-risk environments.

Epidemiology of the Disease

Among the species of E. coli, STEC is a pathogen that leads to an estimated 2.8 million cases of illness annually all over the planet, the majority of which encompass HUS and are caused by O157:H7 (Nemati et al., 2025). Cases of the greatest disease burden are seen in children below the age of 5, and the outbreaks are often related to cattle, processed beef, greens, and water that have not had full treatment. Peaks can be seasonal, like summer and early autumn, due to the higher shedding of bacteria in cattle and the increase in the population due to environmental survivability.

References

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