Prevalence and Antibiotic Resistance Patterns of Escherichia coli in Clinical Samples from Patients in Anyigba, Kogi State, Nigeria

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Abstract

This study aimed to investigate the prevalence of Escherichia coli in clinical samples collected from patients in Anyigba, Kogi State, Nigeria, and to determine the antibiotic resistance patterns of the isolated strains. A total of 200 clinical samples were analyzed, including urine, stool, and blood samples. Escherichia coli was identified in 70 of the 200 samples (35%), with the highest prevalence observed in urine samples (45%). Antibiotic susceptibility testing revealed high resistance rates to ampicillin (80%), tetracycline (60%), and ciprofloxacin (30%), while lower resistance rates were observed for nitrofurantoin (21%) and ceftriaxone (14%). The findings of this study highlight the significant burden of Escherichia coli infections in Anyigba and the urgent need for effective antibiotic stewardship measures to address the rising issue of antibiotic resistance. Further research is necessary to understand the factors contributing to the high prevalence of Escherichia coli in this region and to develop targeted interventions to improve public health.

Key words: escherichia coli; antibiotic resistance; kogi state; public health; microbiology

Introduction

Escherichia coli (E. coli) is a facultative anaerobic bacterium that inhabits the intestines of humans and other warm-blooded organisms. While most strains are benign and play a crucial role in gut health, certain pathogenic strains can lead to serious infections, including urinary tract infections (UTIs), gastroenteritis, and bloodstream infections (Norrby *et al*., 2014). The World Health Organization (WHO) recognizes antibiotic resistance as a major public health threat, with E. coli frequently cited as a key contributor to this crisis (WHO, 2019). The emergence of antibiotic-resistant E. coli strains complicates treatment regimens and increases morbidity and mortality rates associated with infectious diseases (Sokurenko *et al*., 2019).

In Nigeria, the burden of infectious diseases is exacerbated by inadequate healthcare infrastructure, widespread misuse of antibiotics, and limited access to quality medical care. These factors have contributed to rising rates of antimicrobial resistance (Adeleke *et al*., 2020). Reports indicate that resistance to commonly prescribed antibiotics among E. coli strains in Nigeria can reach alarming levels, posing significant challenges to public health (Obi *et al*., 2021). Understanding the prevalence and resistance patterns of E. coli in specific locales is essential for developing targeted public health interventions.

This study focuses on Anyigba, a town in Kogi State, Nigeria, where limited data exists on the prevalence of E. coli and its antibiotic resistance patterns. By analyzing clinical samples from patients in this region, the research aims to provide insight into the local epidemiology of E. coli, thereby informing public health strategies and improving clinical outcomes.

Materials and Methods

Study Area

This study was conducted in Anyigba, a town in Kogi State, Nigeria, characterized by a diverse population and limited healthcare resources. The region faces significant public health challenges, including a high burden of infectious diseases and rising antimicrobial resistance (Adeleke *et al*., 2020).

Sample Collection

A total of 200 clinical samples were collected from patients attending the General Hospital in Anyigba over a six-month period. Samples included 100 urine specimens, 70 stool samples, and 30 blood samples. The collection process adhered to ethical guidelines, and informed consent was obtained from all participants prior to sample collection (Obi *et al*., 2021).

Microbiological Analysis

The samples were processed in the microbiology laboratory of the Teaching Hospital in Anyigba, Kogi State. Each sample was cultured on MacConkey agar, a selective medium that allows for the isolation of gram-negative bacteria, including E. coli (Holt *et al*., 1994). Incubation was carried out at 37°C for 24 hours. Suspected colonies of E. coli were identified based on characteristic colony morphology and biochemical tests, including indole

production, methyl red, Voges-Proskauer, and citrate utilization tests (Bergey *et al.*, 2001).

Antibiotic Susceptibility Testing

Antibiotic susceptibility was assessed using the Kirby-Bauer disk diffusion method, which is a standard technique for determining the resistance of bacteria to antibiotics (Bauer *et al.*, 1966). A panel of antibiotics was selected based on common clinical use, including ampicillin, tetracycline, ciprofloxacin, nitrofurantoin, and ceftriaxone. The results were interpreted according to the Clinical and Laboratory Standards Institute (CLSI)

guidelines, which provide criteria for categorizing bacteria as sensitive, intermediate, or resistant (CLSI, 2021).

Data Analysis

The data obtained were analyzed using descriptive statistics to determine the prevalence of E. coli and the associated antibiotic resistance patterns. The findings were presented in tabular format to facilitate understanding and comparison of results.

Results

Sample Type	Total Samples	E. coli Positive	Prevalence (%)
Urine	100	45	45
Stool	70	21	30
Blood	30	4	25
Total	200	70	100

Table 1: Prevalence of Escherichia coli in Clinical Samples

Antibiotic	Total Isolates Tested	Resistant Isolates	Resistance Rate (%)
Ampicillin	70	56	80%
Tetracycline	70	42	60%
Ciprofloxacin	70	21	30%
Nitrofurantoin	70	15	21%
Ceftriaxone	70	10	14%

Table 2: Antibiotic Resistance Patterns of *Escherichia coli* Isolates

Isolate ID	Ampicillin	Tetracycline	Ciprofloxacin	Nitrofurantoin	Ceftriaxone
EC1	R	R	S	R	S
EC2	R	R	R	S	S
EC3	R	S	S	R	R
EC4	R	R	R	R	R
EC5	S	R	S	R	S
EC6	R	S	R	R	S
EC7	R	R	R	R	R

Table 3: Antibiotic Resistance Profiles of E. coli Isolates

Keys
- R: Resistant
- S: Sensitive

Discussion

The results of this study highlight a significant prevalence of *Escherichia coli* in clinical samples from patients in Anyigba, Kogi State, Nigeria, with an overall detection rate of 35%. This finding aligns with previous research that indicates a high burden of *E. coli* infections in various Nigerian regions, suggesting that this pathogen remains a critical public health concern (Obi *et al.*, 2021). Notably, the highest prevalence was observed in urine samples (45%), which correlates with the established link between *E. coli* and urinary tract infections (Khan *et al.*, 2017).

The antibiotic resistance patterns revealed in this study are particularly alarming. Resistance rates of 80% to ampicillin and 60% to tetracycline indicate a worrying trend that reflects broader issues of antibiotic misuse and overprescription in Nigeria (Adeleke *et al.*, 2020). These findings are consistent with similar studies conducted in different Nigerian locales, which report high resistance rates among *E. coli* strains (Eze *et al.*, 2019). However, the 30% resistance to ciprofloxacin in our study is somewhat lower than what has been reported in some urban centers, where rates have exceeded 50% (Olaitan *et al.*, 2016). This discrepancy could be attributed to varying antibiotic usage patterns and healthcare access across different regions.

The high resistance to commonly prescribed antibiotics such as ampicillin and tetracycline underscores the need for urgent interventions to promote appropriate antibiotic stewardship (WHO, 2019). The results indicate that many local practitioners may rely on outdated treatment protocols that do not reflect current resistance trends. This observation is consistent with the findings of Okonko *et al.* (2012), who emphasized the importance of periodic surveillance to inform clinical practices.

Moreover, the overall resistance patterns observed in this study align with the growing body of literature indicating that *E. coli* is becoming increasingly resistant to first-line antibiotics, thereby complicating treatment options for infections (Norrby *et al.*, 2014). These trends emphasize the importance of local studies to guide public health policies and treatment guidelines tailored to specific regions.

Conclusion

In conclusion, the findings from this study not only highlight the prevalence and antibiotic resistance of *E. coli* in Anyigba but also demonstrate the pressing need for enhanced surveillance, public health education, and effective antibiotic stewardship programs. These measures are crucial for

combating the rising threat of antimicrobial resistance and improving health outcomes in Nigeria.

References

1. Adeleke, O. E., Olowookere, S. A., & Olaniyan, O. T. (2020). Antimicrobial resistance in Nigeria: A systematic review. African Journal of Microbiology Research, 14(4), 77-86.
2. Bauer, A. W., Kirby, W. M. M., Sherris, J. C., & Turck, M. (1966). Antibiotic susceptibility testing by a standardized single disk method. *American Journal of Clinical Pathology*, 45(4), 493-496.
3. Bergey, D. H., Holt, J. G., & Krieg, N. R. (2001). *Bergey's Manual of Determinative Bacteriology* (9th ed.). Lippincott Williams & Wilkins.
4. Clinical and Laboratory Standards Institute (CLSI). (2021). *Performance standards for antimicrobial susceptibility testing* (31st ed.). CLSI Document M100.
5. Eze, E. A., Eze, E. C., & Aiyegoro, O. A. (2019). Prevalence and antibiotic susceptibility of Escherichia coli isolated from urine samples of patients in Enugu, Nigeria. African Journal of Microbiology Research, 13(5), 72-79.
6. Holt, J. G., Krieg, N. R., Sneath, P. H. A., Staley, J. T., & Williams, S. T. (1994). *Bergey's Manual of Determinative Bacteriology* (9th ed.). Williams & Wilkins.
7. Khan, M. N., Naqvi, S. A., & Khan, F. (2017). Prevalence of Escherichia coli in urinary tract infections in a tertiary care hospital. Journal of the College of Physicians and Surgeons Pakistan, 27(1), 25-29.
8. Norrby, S. R., Nord, C. E., & Sande, M. A. (2014). Antimicrobial resistance: The example of Escherichia coli. Infectious Disease Clinics of North America, 28(2), 375-390.
9. Obi, C. L., Asuquo, A. E., & Sogbanmu, O. M. (2021). Prevalence and antibiotic susceptibility of *Escherichia coli* in clinical samples from a tertiary hospital in Nigeria. *Nigerian Journal of Clinical Practice*, 24(5), 685-691.
10. Okonko, I. O., Igbokwe, I. O., & Odu, N. N. (2012). Antibiotic susceptibility patterns of *Escherichia coli* isolates from patients with urinary tract infections in a tertiary hospital in Nigeria. *Journal of Public Health and Epidemiology*, 4(5), 130-134.
11. Olaitan, A. O., Adeleke, A. A., & Akinpelu, D. A. (2016). Antimicrobial resistance patterns of *Escherichia coli* in patients with urinary tract infections in a Nigerian tertiary hospital. *Nigerian Journal of Clinical Practice*, 19(5), 648-652.
12. Sokurenko, E. V., Chesnokova, V., & Hultgren, S. J. (2019). The role of Escherichia coli in urinary tract infections: Insights into bacterial pathogenesis and host responses. Microbiology Spectrum, 7(3).
13. World Health Organization (WHO). (2019). Global action plan on antimicrobial resistance.

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