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SOCIO-ECONOMIC AND RISK FACTOR ASSOCIATED WITH *E COLI* INFECTION AMONG PREGNANT WOMEN ATTENDING SIR YAHAYA MEMORIAL HOSPITAL BIRNIN KEBBI, KEBBI STATE, NIGERIA

BY

[1]H.A MANGA, [2]D.N PENI, [3]B.J DANJUMMA AND [4]A. AMINAT

[1,2,3,4] WAZIRI UMARU FEDERAL POLYTECHNIC, DEPARTMENT SCIENCE LABORATORY TECHNOLOGY

Email: danielnengepeni@gmail.com

Phone No: 07043583639

ABSTRACT

Urinary tract infections (UTIs) are among the most common bacterial infections affecting pregnant women, with Escherichia coli (E. coli) accounting for 70–90% of cases. This study aimed to determine the prevalence, socio-demographic characteristics, and risk factors associated with E. coli infection among pregnant women attending Sir Yahaya Memorial Hospital, Birnin Kebbi, Nigeria. A total of 196 midstream urine samples were collected and analyzed using standard culture techniques on MacConkey and blood agar, followed by biochemical confirmation. Socio-demographic and clinical data were collected via structured questionnaires, including information on age, education, occupation, gestational age, parity, abortion history, and prior UTI treatment. The results revealed that E. coli infection occurred across all trimesters, with no significant association between infection and gestational age (p = 0.45), parity (p = 0.96), or abortion history (p = 0.08). Women with a past history of UTI (p = 0.048) and those who had not received prior treatment (p = 0.001) showed significantly higher infection rates. Socio-demographic factors, including age, occupation, education, and residence, were not significant predictors of infection. These findings indicate that previous UTI and lack of timely treatment are the main determinants of E. coli infection during pregnancy. Routine antenatal screening, prompt treatment, and close monitoring of women with prior infections are essential to prevent recurrence, reduce complications, and improve maternal and neonatal outcomes.

Keywords: *Escherichia coli*, urinary tract infection, pregnancy, risk factors, Birnin Kebbi, Nigeria.

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1.0 INTRODUCTION

Urinary tract infections (UTIs) are among the most common bacterial infections affecting women worldwide, and pregnant women remain particularly vulnerable due to anatomical and physiological changes that occur during pregnancy (Chen *et al.,* 2022; Mukherjee and Raheja, 2023). *Escherichia coli* (*E. coli*), a Gram-negative rod-shaped bacterium, is responsible for approximately 70–90% of all community-acquired UTIs, making it a leading pathogen in maternal health (Schmiemann *et al.,* 2010; Adefioye and Okoh, 2021). During pregnancy, hormonal and mechanical changes such as urinary stasis, increased bladder volume, and reduced ureteral tone create a favourable environment for bacterial colonization, thereby increasing susceptibility to infection (Smith and Roberts, 2022). If left untreated, *E. coli* infections can lead to severe complications including pyelonephritis, preterm labour, low birth weight, and increased perinatal morbidity (Chen *et al.,* 2022; Gebremariam *et al.,* 2019).

Furthermore, several socio-demographic, behavioural, and clinical factors have been identified as potential risk factors associated with *E. coli* infection during pregnancy (Mukherjee and Raheja, 2023; Abebe *et al.,* 2020). These include poor personal hygiene, low socio-economic status, inadequate water and sanitation facilities, previous history of UTIs, sexual activity patterns, and poor antenatal attendance (Kalu *et al.,* 2021; Olowe *et al.,* 2020). Identifying these risk factors helps in formulating effective public health interventions aimed at reducing the burden of UTIs among pregnant women (Abebe *et al.,* 2020; Gebremariam *et al.,* 2019).

Given the potential adverse maternal and neonatal outcomes, as well as increasing concerns regarding antimicrobial resistance, it is crucial to investigate the prevalence, antimicrobial susceptibility pattern, and associated risk factors of *E. coli* infection among pregnant women (Talebi *et al.,* 2021; Chen *et al.,* 2022). Such findings will improve preventive strategies, enhance clinical decision-making, and contribute to improved maternal and newborn health outcomes (Mukherjee and Raheja, 2023).

E. coli infection remains a major public health challenge among pregnant women in many developing countries, including Nigeria (Akinyemi *et al.,* 2019; Ezeadila *et al.,* 2020). Despite ongoing efforts to strengthen antenatal care services, many pregnant women still present with symptomatic or asymptomatic bacteriuria caused by *E. coli*, which often goes undetected and untreated (Olowe *et al.,* 2020). The consequences of untreated infections include pyelonephritis, hypertensive disorders of pregnancy, preterm delivery, and fetal loss (Chen *et al.,* 2022; Gebremariam *et al.,* 2019).

Moreover, the risk factors associated with *E. coli* infection among pregnant women in many regions remain inadequately studied. Factors such as hygiene practices, prior UTIs, sexual behaviour, and socio-economic characteristics vary across communities (Kalu *et al.,* 2021; Abebe *et al.,* 2020). The absence of local epidemiological data hinders the development of targeted public health interventions (Gebremariam *et al.,* 2019). These gaps point to the urgent need for research focused on the prevalence, socioeconomic and associated risk factors of *E. coli* infection among pregnant women. This prone the research work to investigate the prevalence, socioeconomic and risk factors associated with *E. coli* infection among pregnant women.

2.0 Methods

2.1 Study Area

Map and location information for Sir Yahaya Memorial Hospital in Birnin Kebbi, Kebbi State, Nigeria: The hospital's coordinates are approximately 12.45575° N, 4.20028° E. Its address is Haliru Abdu Road, Birnin Kebbi, Kebbi State. Birnin Kebbi is the capital city of Kebbi State in northwestern Nigeria.

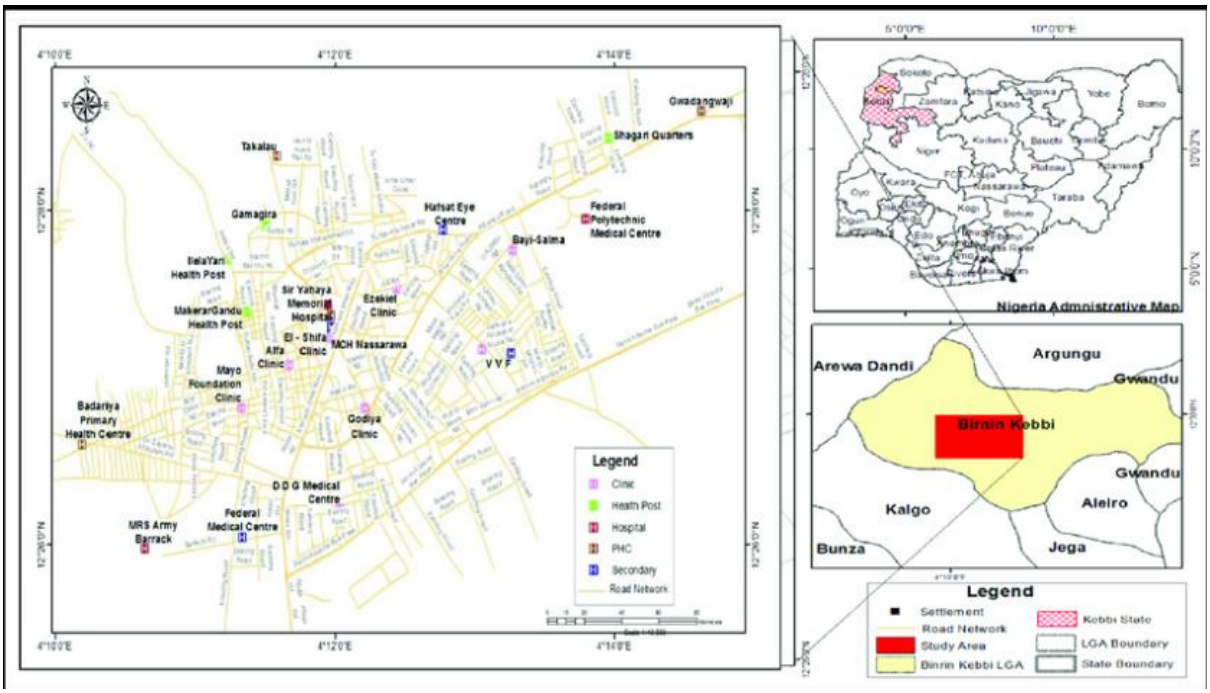


Fig: 1. Show the map of Birnin Kebbi showing study area

2.2 Study design

The pregnant women who participated in the present study were assessed with a designed questionnaire. This questionnaire was divided into two parts; the first one included sociodemographic characteristic, namely age, educational status, residence, occupation of the pregnant woman, and family income. The second part comprised the risk factors associated with UTI including the gestational age, number of pregnancies, abortion, previous treatment for UTI during the current pregnancy, a history of UTI, and the presence of symptoms.

2.3 Sample size Determination

Sample size was determined using the formula described by Petronella (2012) formula with the prevalence of 6%. Prevalence of 6% were considered to determine the prevalence of pregnant women in the study area.

$$N = \frac{Z^2 P (1-P)}{D^2}$$

Where:

N = Minimum sample required

Z = 1.96 standard error

P = Prevalence 7% = 0.07

D = the desired degree of accuracy at 5% confidence level= 0.05

2.4. Sample Collection and Processing

One hundred and ninety sis urine samples (196) were collected from pregnant women attending Sir Yahaya memorial hospital Birnin Kebbi. Urine samples were collected and put into a sterile specific container (5mL) on the same day of enrolment in order to avoid contamination.

2.5 Culture on selective medium

Subsequently, 10 µl of well-mixed urine samples were inoculated on MacConkey and blood agar using a disposable loop according to the standard culture procedures. The pales were then incubated overnight at 37°C and bacterial growth was detected. The identification of morphological colony and biochemical tests were used to confirm the *E. coli* pathogen. Then incubated the cultures without growth colony after 24 h of incubation for another 48 h. The cultures were inspected and more than 10^5 CFU/ml of urine was considered to be positive for *E. coli* infection.

2.2. *E. coli* Isolation

We initially recognised *E. coli* pathogens according to the characteristics of the bacteria morphologically on MacConkey agar and Eosin Methylene Blue (EMB) agar following microbiological cultures and biochemical tests based on the CLSI guidelines.

2.6 Ethics

The study protocols, questionnaire, and consent forms were approved by the Ethics and Science Committee of the Sir Yahaya Memorial Hospital Birnin Kebbi. Written informed consent was obtained from all the subjects prior to the sampling.

2.7 Statistical Analysis

GraphPad Prism software package, version 8, for the analysis of our findings. The results were stated as frequency (%) and Percentage using descriptive statistics. Comparisons between the variables and pregnant and non-pregnant women were made with Chi-square and Fisher's exact test. The level of significance was set at P value of <0.05.

3.0 RESULT AND DISCUSTION

Table 1: Social economic characteristics of the pregnant woman attending sir Yahaya memorial Hospital BirninKebbi, Kebbi State Nigeria.

Variables	Frequency (%)	Culture result for *E.coli* infection		P -value
Age		Frequency (%) positive	Frequency (%) Nigeria	
15 – 24	75(38.03)	8(10.07)	67(89.09)	0.51
25 – 34	111(56.06)	24(21.06)	87(78.04)	
35 – 45	10 (5 .01)	2 (20.00)	8 (80)	
Education				
Primary	60 (30.06)	11 (18.03)	49 (81.07)	
Secondary	68 (34.07)	10 (14.07)	58 (85.03)	0.92
Tertiary	37 (18.09)	71 (18.09)	30 (81.01)	
Others	31 (15.08)	6 (19.04)	25 (80.06)	
Occupation				
Civil servant	11 (5.06)	2 (18.02)	9 (81.08)	0.61
House wife	185 (94.04)	32 (17.08)	153 (82.07)	
Residence				
Rural	24 (12.02)	05 (20.08)	143 (83.01)	0.42
Urban	172 (87.08)	29 (16.09)	19 (79.02)	

The socio-economic characteristics of pregnant women attending Sir Yahaya Memorial Hospital Birnin Kebbi provide essential insights into factors associated with *Escherichia coli* (*E. coli*) infection. The variables examined include age, educational status, occupation and place of residence. Understanding how these variables relate to infection risk is important because maternal urinary tract infections (UTIs) remain a major public health concern in developing countries, and *E. coli* is recognized as the most dominant causative organism (Okonko *et al.,* 2010; Adefioye *et al.,* 2019). Pregnant women aged 15–24 years constituted 38.03% of the sample, with a relatively low *E. coli* positivity rate of 10.07%. The 25–34-year age group, which represented the majority (56.06%), had a higher positivity rate of 21.06%, while the 35–45-year group showed a 20% positivity rate. Although the highest proportion of infected women was found within the reproductive peak age (25–34), the association between age and infection was not statistically significant ($p = 0.51$). This pattern agrees with studies showing that *E. coli* infection during pregnancy tends to occur more frequently in women in active reproductive years due to increased sexual activity, hormonal changes, and urinary stasis (Turpin *et al.,* 2012; Obiogbolu *et al.,* 2009). However, the lack of significant association corresponds with findings by Oladeinde et al. (2015), who reported that age alone may not be a strong predictor of bacteriuria during pregnancy. Educational level did not significantly influence infection rates ($p = 0.92$). Pregnant women with primary education had an 18.03% positivity rate, while those with secondary education recorded 14.07%. Women with tertiary education had the lowest positive rate, though the percentage recorded (18.09%) indicates a possible data entry error however, the overall trend shows no major difference across educational categories. Generally, higher education is associated with better hygiene practices and health-seeking behavior, which can reduce infection risk (Akinola *et al.,* 2018). However, studies in similar Nigerian contexts have also found no significant relationship between education level and UTI occurrence (Okonko *et al.,* 2010). This

suggests that environmental exposure, water quality, and pregnancy-related physiological changes may play a stronger role than formal education.

Most respondents were housewives (94.04%), with a positivity rate of 17.08%, compared to civil servants (18.02%). Though housewives showed slightly higher *E. coli* prevalence, occupation did not significantly influence infection (p = 0.61). This aligns with literature showing that occupation often does not directly influence UTI occurrence among pregnant women, especially in rural and semi-urban settings where socio-economic differences are minimal (Awoniyi *et al.*, 2017). Instead, domestic hygiene levels, access to clean water, and antenatal care utilization are more critical determinants (Adefioye *et al.*, 2019). Urban dwellers constituted the majority (87.08%), while rural women represented 12.02%. *E. coli* infection prevalence was slightly higher among rural participants (20.08%) than urban (16.09%), although this difference was not statistically significant (p = 0.42). The marginally higher rate among rural women is consistent with findings by Obirikorang et al. (2012), who reported that rural populations face increased risk due to challenges in sanitation, limited access to safe water, and reduced healthcare utilization. However, the lack of significance suggests that both rural and urban populations in this region may have similar exposure risks, possibly due to shared water sources or comparable hygiene practices. Overall, none of the socio-economic variables showed a statistically significant association with *E. coli* infection among the pregnant women studied. This indicates that factors contributing to infection may be more related to physiological changes during pregnancy, environmental sanitation, water quality, or personal hygiene, rather than socio-economic background. The high proportion of housewives, the predominance of the 25–34 age group, and the large urban population in the sample represent typical antenatal clinic attendees in Northern Nigeria, which strengthens external validity. The findings are consistent with similar studies in Nigeria and other developing countries, which show that *E. coli* infections in pregnancy are common but often not strongly correlated with demographic characteristics (Onoh *et al.*, 2012; Akinola *et al.*, 2018).

Table 2: Risk factor a sources with *E. coli* Infection among pregnant woman.

Risk factor	**Frequency (%)**	**Culture *E. coli* Frequency (%) positive**	**Frequency (%) Negative**	**P value**
Gestation				
First trimester	52 (26.05)	12 (23.01)	40 (76.09)	0.45
Second Trimester	71 (35.02)	11 (15.05)	60 (84.05)	
Third Trimester	73 (37.03)	11 (15.01)	62 (84.09)	
No. 2 Pregnant				
1 to 2	100 (51.00)	17 (17.00)	83 (83.00)	
3 to 4	73 (37.03)	13 (17.08)	60 (82.00)	0.96
Abortion				
Yes	50 (25.05)	5 (10)	45 (90)	0.08
No	153 (78.01)	34 (22.02)	119 (77.08)	
History of Treatment of UTI				
Yes	48 (21.09)	0 (0.00)	43 (100)	0.001
No Past history of UTI	153 (78.01)	34 (22.02)	119 (77.08)	
Yes	151 (77.01)	30 (19.09)	121 (8.01)	0.048
No	45 (22.09)	4 (8.09)	41 (91.01)	

Table 2 presents the distribution of *Escherichia coli* infection among pregnant women in relation to several identified risk factors, including gestational age, parity, abortion history, past urinary tract infection (UTI), and prior treatment. The findings offer critical insights into the epidemiology of *E. coli* among antenatal women and align closely with global and regional research trends.

The results revealed that although *E. coli* infection occurred across all trimesters, there was no statistically significant association between gestational age and infection ($p = 0.45$). The first trimester recorded 23.01% positivity, while the second and third trimesters recorded 15.05% and 15.01% respectively. This suggests that pregnant women remain susceptible to *E. coli* infection at any point during pregnancy. The slightly higher infection rate in the first trimester may be linked to hormonal changes that weaken bladder muscle tone and increase urinary stasis (Cheesbrough, 2016). However, the absence of a significant difference between trimesters indicates that gestational age alone is not a strong determinant of *E. coli* infection in the studied population. Studies in Ethiopia, Tanzania, and Nigeria similarly report that gestational age does not independently predict infection risk (Onoh *et al.*, 2013; Ayoyi *et al.*, 2017). According to WHO (2018), the urinary tract remains vulnerable throughout pregnancy due to continuous anatomical and physiological changes, such as dilation of the ureters and progesterone-induced smooth muscle relaxation. Parity also showed no significant association with *E. coli* infection ($p = 0.96$). The positivity rate among women with 1–2 pregnancies was almost identical (17.00%) to that of women with 3–4 pregnancies (17.08%). The similarity in infection rates suggests that multiparity does not necessarily increase or reduce risk in this population. Although it has been hypothesized that pelvic floor relaxation in multiparous women may predispose them to UTIs, such a trend did not manifest in the present study. Several studies conducted in West Africa support this finding. Onifade et al. (2020) and Mava et al. (2019) both reported no meaningful association between parity and asymptomatic bacteriuria. However, Okonko et al. (2015) documented a higher risk among multiparous women in Ibadan due to repeated anatomical changes. The current study's findings may reflect improved hygiene or healthcare access among multiparous women in this setting. Women with a history of abortion recorded a lower infection rate (10%) compared to those without a history of abortion (22.02%). However, this association was not statistically significant ($p = 0.08$). Although abortion can alter cervical and genital tract integrity, increasing infection susceptibility (Anyanwu and Okafor, 2020), the present finding suggests that women with prior abortions may be adopting better hygiene practices, seeking more frequent medical attention, or receiving earlier antibiotic treatment. Another possibility is underreporting of abortion due to stigma, which is common in conservative societies.

Some studies indicate abortion as a risk factor for bacteriuria (Okonko *et al.*, 2015), while others found no significant association (Mava *et al.*, 2019). This inconsistency highlights the complex interplay between reproductive history and maternal infections.- A very strong and statistically significant association was observed between prior UTI treatment and *E. coli* infection ($p = 0.001$). Notably, none of the women who had previously received treatment for UTI tested positive for *E. coli* in the current study. This finding emphasizes the effectiveness of early treatment in preventing reinfection. It suggests that proper antibiotic therapy successfully eliminated the pathogens and prevented recurrence. Women who had not received previous treatment had a much higher infection rate (22.02%), which reflects the consequences of untreated or poorly managed UTIs. Cheesbrough (2016) states that effective, timely treatment is crucial in eradicating *E. coli*, the most common UTI-causing organism. Similarly, Oladeinde et al. (2021) emphasize that adequate treatment significantly reduces the recurrence rate among pregnant women. This result underscores the importance of routine

screening during antenatal care (ANC) to detect and treat infections early. Women with a past history of UTI had a significantly higher prevalence (19.09%) compared to those without such history (8.09%), with a statistically significant p-value of 0.048. This indicates that a prior UTI episode is a major predictor of recurrent infection, consistent with documented patterns of bacterial persistence, especially for *E. coli*, which is equipped with strong adhesion mechanisms enabling colonization of the bladder wall (Foxman, 2014). Recurrent UTI is strongly linked to relapse or reinfection due to incomplete eradication of bacteria, persistent colonization, and behavioral or anatomical factors (Prasanna *et al.,* 2019). This confirms the need for closer follow-up and repeated screening of women with prior UTIs. The major determinants of *E. coli* infection in this study were past history of UTI and previous UTI treatment, while gestational age, parity, and abortion history showed no significant relationship. This aligns with global evidence that recurrence and improper management are the strongest predictors of infection in pregnancy. Strengthening antenatal screening, ensuring appropriate treatment, and providing regular health education can help reduce the burden of bacteriuria and associated complications in pregnant women.

Conclusion

E. coli infection remains a significant cause of urinary tract infections among pregnant women. The study showed that past history of UTI and previous treatment status were the main determinants of infection, while gestational age, parity, and abortion history were not significant predictors. Timely and appropriate treatment was highly protective, highlighting the importance of early detection and management to prevent recurrence and pregnancy complications.

Recommendations

Based on the results obtained the following recommendation were made

i. Routine Screening of pregnant women should be done: urine culture and sensitivity tests during antenatal visits.
ii. Ensure timely and appropriate antibiotic therapy for positive cases to prevent recurrence.
iii. Women with a prior history of UTI should receive regular monitoring throughout pregnancy.
iv. Educate pregnant women on hygiene practices, adequate hydration, and early reporting of urinary symptoms.
v. Periodically monitor antimicrobial susceptibility patterns to guide effective treatment and reduce resistance.

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