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Original Research Article

Prevalence, resistant pattern and associated risk factors of asymptomatic bacteriuria among antenatal clients in a municipal hospital in Ghana

Solomon D. Y. Kwashie[1], Benjamin Tetteh Mensah[2], Israel Attipoe[1], Eric Akorly[1], Victor A. Degenu[3], Edward K. Kupeh[4], Dominic Danyi[5], William Osei-Owusu[6], Maxwell Kwame Dzokoto[7]*

[1]Department of Medical Laboratory Sciences, University for Development Studies, Tamale, Ghana
[2]School of Biomedical and Allied Health Sciences, University of Ghana, Ghana
[3]Department of Medical Laboratory, Korle Bu Teaching Hospital, Accra, Ghana
[4]Ghana Health Services, Accra, Ghana
[5]Department of Medical Laboratory, Juaboso government Hospital, Juaboso, Ghana
[6]Department of Medical Diagnostics, College of Health and Well-Being, Kintampo, Ghana
[7]Department of Health Information Management, College of Health and Well-Being, Kintampo, Ghana

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***Correspondence:**
Dr. Maxwell Kwame Dzokoto,
E-mail: drmvkshirsagar@yahoo.co.in

ABSTRACT

Background: The aim of the study was to determine the prevalence and factors associated with asymptomatic bacteriuria among pregnant women.
Methods: A cross-sectional study was used to determine the prevalence of uro-pathogens among pregnant women attending Antenatal Clinic at Weija-Gbawe Municipal Hospital. The data was collected between May 2023 and October 2023. The data collection process involved the use of a structured questionnaire, while urine specimens were collected in sterile urine containers and cultured on CLED medium. The bacteria colonies were identified and evaluated for their susceptibility to antibacterial agents. Multiple logistics regression was used to determine the factors associated with bacteriuria among pregnant women.
Results: The age range of the participants was 14 years to 45 years with mean age of 30 years (SD±6.5). About 13% of the participants had no formal education. Majority (77.4%) of study participants were obese while only 3.42% had normal weight. Isolates were *Escherichia coli* (27%), *Klebsiella species* (23%), *Proteus species (18%)* and *Citrobacter koseri* (18%). Gentamicin was sensitive to *E. coli* and cotrimoxazole was the most resistant antibiotics. Factors such as BMI, educational level, smoking status, recurrent UTI, parity were not found to have statistical influence on prevalence of bacteriuria among pregnant women.
Conclusions: The study revealed 15.1% prevalence of ASB among pregnant women with *E. coli* being the predominate isolates. Gentamicin and cotrimoxazole were the most sensitive and resistant antibiotics respectively. Pregnant women should be advised to adhere to optimal hygiene practices and safe sexual behaviours, with a focus on the role of these practices in preventing uro-pathogen colonization.

Keywords: Accra, Antenatal clinic, Pregnant women, Prevalence, Uro-pathogens, Weija-Gbawe

INTRODUCTION

Urinary tract infections (UTIs) are a prevalent type of bacterial infection that can affect various segments of the urinary system, including the bladder, urethra, and kidneys.[1] During pregnancy, UTIs can pose a significant health concern due to the physiological changes that occur in the urinary tract as well as the potential adverse effects on both maternal and foetal health.[2-4] The prevalence of UTIs among pregnant women has been a subject of interest for researchers and healthcare providers, as it has a direct impact on the well-being of both the mother and the developing foetus.[5] Untreated urinary tract infections (UTIs) during gestation possess the potential to result in a spectrum of complications, some of which may have dire ramifications for both the mother and the developing foetus.[6,7]

Notably, UTIs are correlated with an augmented risk of premature labour, low birth weight, and even maternal and neonatal mortality.[8] The infection has the potential to ascend to the kidneys, thereby leading to pyelonephritis, a more severe and potentially life-threatening ailment.[8] In conjunction with the immediate risks, there is mounting evidence to suggest that maternal infections during gestation may have enduring effects on the offspring's health.[9] Urinary tract infections are commonly associated with various types of bacteria, including *Escherichia coli*, *Klebsiella pneumoniae*, and *Staphylococcus saprophyticus.*[10]

During pregnancy, numerous changes happen in a woman's body that increase the risk of developing a UTI. These alterations include modifications in the composition of urine and the immune system, as well as increased pressure on the bladder as the baby grows. Pregnant women are more likely to develop repeated or more severe UTIs compared to non-pregnant women. Up to 1 in 10 pregnant women may experience a UTI during their pregnancy.[11,12] Despite the known risks, there is an insufficiency of comprehensive data regarding the prevalence of specific uro-pathogens responsible for UTIs among pregnant women who attend antenatal clinics in hospitals including Weija-Gbawe Municipal Hospital (WGMH). It is crucial to understand the prevalence of these uro-pathogens in order to tailor effective preventive measures, diagnostic approaches, and treatment strategies.

METHODS

Study site

The WGMH is a 50-bed secondary hospital which provides medical health services to the communities around the Weija-Gbawe Municipal Assembly. Services provided by the hospital include child welfare clinic, family planning, nutrition and antenatal care (ANC). The ANC unit records an average attendance of 50 pregnant women daily and the Unit has 10 beds for deliveries.

Study design

The study employed cross-sectional study design to collect data from May 2023 through August 2023 at the Weija-Gbawe Municipal Hospital (WGMH).

Inclusion criteria

Pregnant women without any signs and symptoms of UTI after screening with routine urine examination test were included in the study.

Exclusion criteria

Pregnant women attending the antenatal clinic on account of obstetric emergencies were excluded from urine sampling. Pregnant women who were on antibiotic treatment two weeks prior to sample collection were also excluded from the study.

Sample size determination

For Urine specimen, the minimum sample size of pregnant women was determined using the

Cochran's formula: $n=Z^2p\ (1-p)/e^2$

Where; n is the minimum sample size, Z is the standard z score=1.96, p is the proportion of pregnant women with asymptomatic bacteriuria=0.08 (13), e is the margin of error=0.05.

Substituting these values into the Cochran's formula will result in a sample size of=116 participants.

Data collection

Study participants were recruited after accepting to participate in the study and duly signing an informed consent form. Well-trained health workers translated the questions into the local dialect for those who were not able to read or write and this was done confidentially. Respondents were recruited consecutively until sample size was reached. Structured questionnaires were used to collect data on variables such as sociodemographic characteristics, smoking status, recurrent UTI, month in which the participant started antenatal care clinic and parity.

Urine specimen collection

After responding to the questionnaires, the participants were educated on how to take the urine specimen to avoid contamination. A sterilized plastic wide mouth leak proof screw-capped transparent urine container, well label with a unique participant identification number, age and time of collection was given to the participant to produce about 10–20 mL of mid-stream urine specimen. Overall, 130 Urine specimens were collected from pregnant women. The specimens were transported to the laboratory for

immediately for analysis. In cases of delay in transporting the urine specimen to the laboratory, samples were stored between +2°C and +8°C.

Laboratory processing of urine specimen

Urine specimen processing was carried out in 2 phases. Phase 1 involved isolation and identification of bacteria from urine sample and Phase 2 focused on determining the antibiogram of isolated bacteria from the urine specimens.

Phase 1 - Isolation and identification of bacteria from urine sample

Bacteriological analysis to isolate members of the family of Enterobacteriaceae was carried out at the Central Laboratory of the Korle Bu Teaching Hospital, Accra. Using a sterile calibrated wire loop (0.002 mL), the urine specimens were inoculated on Cysteine Lactose Electrolyte Deficient (CLED) agar and 5% sheep blood agar for the primary isolation of uro-pathogen. The culture plates were incubated between 35 ^{0}C to 37 ^{0}C aerobically for 18-24 hours. Morphological identification, biochemical tests, colony count and sensitivity testing were performed on culture media with bacterial growth after 12 hours of incubation.[14]

Phase 2 - Antimicrobial susceptibility testing (AST)

Identified distinct colonies were picked from CLED and sub-cultured on Mueller Hinton agar for antimicrobial susceptibility testing. A loopful of bacteria was taken from the pure colony, put in 0.85% NaCl solution, and mixed gently until a homogenous solution was attained.

The turbidity of the solution was adjusted to optical density of 0.5 McFarland standard to standardize the inoculum size. A sterile cotton swab was dipped into the solution and the soaked cotton swab was gently pressed against the inner wall of the tube containing the solution to remove excess solution. The cotton bag was used to streak on the entire surface of Muller Hinton agar. The inoculum plate was left at room temperature to dry for about 3 minutes. Antibiotics disk was placed on the Muller Hinton agar using a sterile forceps and place in an incubator for 18 - 24 hours at 35^{0}C-37^{0}C, after which the sensitivity results were documented.[13,14]

Laboratory quality control

Standard operational procedures (SOP) were strictly followed during each procedure. The preparation of the media as well as the antibiotics used to perform the tests were adopted from the Clinical and Laboratory Standards Institute (CLSI) guidelines by de Sousa et al. An autoclave tape was used during the preparation of the media to check for a complete sterilization. Susceptibility testing was done using *E.coli* strain ATTC 25922(15).

Data management plan

Laboratory data sheets was completed by the investigators and data was stored in bound folders and put under lock until data entry. Data was entered into Microsoft Excel and protected using a password that was known by the investigators. Data was cross-checked for errors that might arise during data entry. Any errors that were noticed were corrected prior to data analysis.

Data analysis

Data was analysed using Stata version 14 (StataCorp, College Station, Texas, USA). Firstly, the data was explored and checked for missing values. Continuous variables were tested for normality using Shapiro-Wilk test for normality. The outcome variable was dichotomized as 0 “Negative” and 1 “Positive”. Mean and standard deviations were used to describe continuous variables that were normally distributed and percentages were used to describe categorical variables. Each of the selected risk factors were assessed independently with the outcome variable (bacteriuria) in a chi-square test. If one or more expected values in a cross tabulation are less than 5, Fisher’s exact test was used instead of a chi-square test. The multiple logistic regression model with robust variance estimator at a 95% confidence interval considered all risk factors from the chi-square test. Even though these factors were not significant from the chi-square test, studies elsewhere have showed that they are significant predictors of bacteriuria in pregnancy.[16,17] The risk factors included in the multiple logistic regression model were significant at $p<0.05$.

RESULTS

The mean age of the study participants was 30.0±6.5. The percentage of women aged 26-5 was about 60% and those aged 26-45 constituted the least (11.64%). About 36% of the respondents completed basic level of education, 34.25% completed secondary level and about 15% completed tertiary education. Almost equal proportions of the respondents were non-government employee and traders, 38.36 and 39.04 respectively. Majority (77.40%) were obese and only 3.42% had normal weight (Table 1).

Figure 1 shows the antimicrobial susceptibility patterns of four (5) distinct bacterial strains that were identified from study participants at the Weija-Gbawe Municipal Hospital. The bacterial strains were all Gram-negative bacteria, namely *Escherichia coli*, *Klebsiella spp*, *Proteus spp*, *Citrobacter koseri* and, *Citrobacter freundi*. The percentage of *E. coli* and *Klebsiella* species was 27% and 23% respectively, *Proteus* spp and *Citrobacter koseri* each was 18% and *Citrobacter freundii* was 14%.

Table 2 shows the characteristics of respondents stratified by bacteriuria. Among those with positive culture results, 65% belonged to 26 to 35 age group, 75% were obese and 40% completed basic level of education. Ninety-six

percent (96%) of non-smokers had positive culture results, all those with positive culture results do not drink alcohol and 90% of those with recurrent UTI had positive culture results. Among those with negative culture results, 97% of the women have never been diagnosed of diabetes, 87% had sex once a week and 94% did not lose pregnancy in the past. Forty percent (40%) of those with negative culture results reported to the health facility 6 month after getting pregnant, 46% of them were in their first trimester and 49% had no child.

Table 1: Sociodemographic characteristics of study participants (n=146).

Variables	Frequency (N)	Percentage
Age group (years)		
14-25	40	27.40
26-35	89	60.96
36-45	17	11.64
Age (years), mean (SD)	30.0 (6.5)	
Educational level		
No formal education	20	13.70
Basic	53	36.30
Secondary	50	34.25
Tertiary	23	15.75
Occupation		
Government worker	22	15.07
Non-gov't worker	56	38.36
Trader	57	39.04
Housewife	8	5.48
Student	3	2.05
BMI		
Normal weight	5	3.42
Overweight	28	19.18
Obesity	113	77.40

Table 2: Characteristics of respondents stratified by bacteriuria (n=146).

Variables	Culture results		Chi-square value	P value
	Negative	Positive		
	N=94 (%)	N=52 (%)		
Age group (years)			4.81	0.090
14-25	24 (26)	16 (31)		
26-35	55 (59)	34 (65)		
36-45	15 (16)	2 (4)		
Age (years), mean (SD)	30.0 (6.5)			
BMI			1.23	0.540
Normal weight	4 (4)	1 (2)		
Overweight	16 (17)	12 (23)		
Obesity	74 (79)	39 (75)		
Educational level			2.63	0.450
No formal education	16 (17)	4 (8)		
Basic	32 (34)	21 (40)		
Secondary	31 (33)	19 (37)		
Tertiary	15 (16)	8 (15)		
Occupation			8.87	0.064
Government employee	12 (13)	10 (19)		
Non-gov't employee	41 (44)	15 (29)		
Trader	35 (37)	22 (42)		
Housewife	6 (6)	2 (4)		
Student	0 (0)	3 (6)		
Smoking status			0.01	0.910
No	90 (96)	50 (96)		

Continued.

Variables	Culture results		Chi-square value	P value
	Negative	Positive		
	N=94 (%)	N=52 (%)		
Yes	4 (4)	2 (4)		
Drink alcohol				
No	89 (95)	52 (100)	2.86	0.091
Yes	5 (5)	0 (0)		
Weekly sex frequency				
Once a week	82 (87)	49 (94)	1.96	0.370
Thrice	1 (1)	0 (0)		
Twice	11 (12)	3 (6)		
Lost pregnancy in the past				
No	88 (94)	51 (98)	1.46	0.230
Yes	6 (6)	1 (2)		
Gestational diabetes				
No	91 (97)	52 (100)	1.69	0.190
Yes	3 (3)	0 (0)		
Recurrent UTI before pregnancy				
No	90 (96)	47 (90)	1.66	0.200
Yes	4 (4)	5 (10)		
ANC start month				
First month	24 (26)	14 (27)	0.50	0.780
Third month	32 (34)	20 (38)		
Sixth month	38 (40)	18 (35)		
Gestational age (Trimester)				
First trimester	43 (46)	28 (54)	1.93	0.380
Second trimester	36 (38)	14 (27)		
Third trimester	15 (16)	10 (19)		
Parity				
No child	46 (49)	24 (46)	0.89	0.64
One to two	37 (39)	19 (37)		
Three and above	11 (12)	9 (17)		

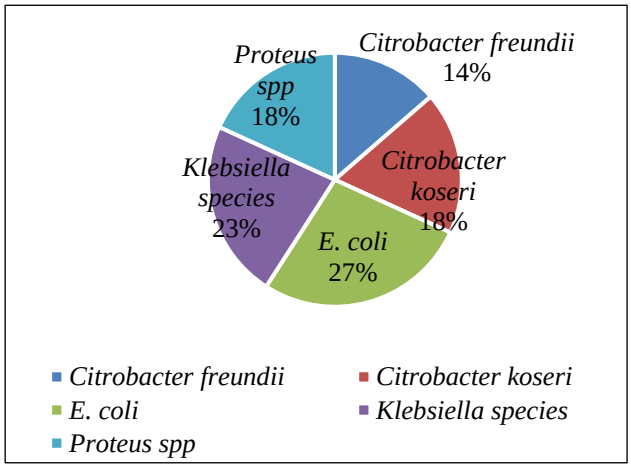

Figure 1: Percentages of isolated uro-pathogens among pregnant women.

Table 3 shows the resistant pattern of isolate from the urine specimen of the study participants. In general, the isolates showed resistant rate of 90.91% to cotrimoxazole. Their resistance against nalidixic acid, nitrofurantoin and tetracycline was 81.82%. Similarly, the isolates showed same resistant rate of 77.23% against gentamicin and amikacin. Ceftriaxone recorded the lowest resistance rate (40.90%) compared to the rest of the antibiotics tested. Gentamicin was the most effective drug against *E. coli* with sensitivity rate of 88.24%. *Citrobacter koseri*, *Klebsiella* species and *Citrobacter freundii* were all fully sensitive to amikacin, ceftriaxone and levofloxacin respectively. However, *Citrobacter koseri* was relatively resistant to amplicillin (6.25%) and cefuroxime (18.18%). *Klebsiella* species was also relatively resistant to levofloxacin (18.75%) and cefuroxime (18.18%). Cefuroxime was the most effective drug against *Citrobacter freundii* with a sensitivity rate of 90.91%.

This study did not find any significant factors that were associated with bacteriuria, however, pregnant women between the age of 26 to 35 had 11% less risk of experiencing bacteriuria compared to those aged 14 to 25 years (aOR = 0.89; 95%CI: 0.311, 2.549; p=0.829). This rate further reduced to 84% among those who belonged to 36 to 45 years (aOR = 0.16; 95%CI: 0.026, 0.997; p value=0.050). Those who were overweight had 3.85 times higher odds of experiencing bacteriuria compared to those with normal weight (aOR = 3.85; 95%CI; p value=0.284).

The odds of experiencing bacteriuria reduce as the respondents climbs higher on the educational ladder. For example, those who completed basic level of education had 2.80 times higher odds of experiencing bacteriuria compared to those with no formal education (aOR=2.80; 95% CI: 0.692, 11.361; p value=0.148). This odds reduced among those who completed secondary level of education (aOR=2.26; 95% CI: 0.552, 9.221; p-value = 0.257) and further reduced among those who completed tertiary level of education (aOR = 0.46; 95% CI: 0.047, 4.587; p value=0.512). Smokers have 36% higher odds of experiencing bacteriuria compared to those who did not smoke (aOR = 1.36; 95% CI: 0.177, 10.372; p value=0.769). Those who engaged in sexual activity more than once a week had 73% less risk of experiencing bacteriuria compared to those who engaged in sexual activity once a week (aOR=0.27; 95% CI: 0.053, 1.366; p value=0.114). Pregnant women with recurrent UTI before getting pregnant had 3.23 times higher odds of experiencing bacteriuria compared to those with no history of recurrent UTI (aOR = 3.23; 95% CI: 0.512, 20.333; p-value = 0.212). Pregnant women who reported to health facility three months after getting pregnant had 75% higher odds of experiencing bacteriuria compared to those who reported to health facility after the first month of pregnancy (aOR=1.75; 95% CI: 0.613, 4.995; p value=0.295). This odds increased to 2 times among women who reported to the health facility after six month of getting pregnant compared to those who reported to health facility after the first month of pregnancy (aOR = 2.01; 95% CI: 0.632, 6.412; p-value=0.236). Women with three or more children have more than twice the odds of experiencing bacteriuria compared to those with no children (aOR=2.24; 95% CI: 0.616, 8.120; p value=0.221) (Table 4).

Table 3: Antimicrobial resistance pattern of uro-pathogens among pregnant women (n=146).

Organisms (n)	Number of bacteria species (%) resistant to the antibiotics tested									
	GEN	AMP	NLA	TET	NTF	AMK	COT	CTX	LFX	CFX
***Citrobacter freundii* (n=3)**	2 (11.76)	3 (18.75)	2 (11.11)	2 (11.11)	3 (16.67)	3 (17.65)	3 (15.00)	2 (22.22)	0 (0.00)	1 (9.09)
***Citrobacter koseri* (n=4)**	4 (23.53)	1 (6.25)	4 (22.22)	4 (22.22)	4 (22.22)	0 (0.00)	4 (20.00)	3 (33.33)	4 (25.00)	2 (18.18)
***E. coli* (n = 6)**	2 (11.76)	5 (31.25)	4 (22.22)	5 (27.78)	4 (22.22)	5 (29.41)	5 (25.00)	3 (33.33)	6 (37.50)	4 (36.36)
***Klebsiella* species (n=5)**	5 (29.41)	5 (31.25)	5 (27.78)	3 (16.67)	4 (22.22)	5 (29.41)	4 (20.00)	0 (0.00)	3 (18.75)	2 (18.18)
***Proteus* spp (n=4)**	4 (23.53)	2 (12.50)	3 (16.67)	4 (22.22)	3 (16.67)	4 (23.53)	4 (20.00)	1 (11.11)	3 (18.75)	2 (18.18)
Total (n=22)	17 (77.23)	16 (77.73)	18 (81.82)	18 (81.82)	18 (81.82)	17 (77.23)	20 (90.91)	9 (40.91)	16 (72.73)	11 (50.00)

Table 4: Factors associated with bacteriuria among pregnant women (n=146).

Variables	aOR	95% CI	P value
Age (years)			
14-25	1.00		
26-35	0.89	(0.311, 2.549)	0.829
36-45	0.16	(0.026, 0.997)	0.050
BMI			
Normal weight	1.00		
Overweight	3.85	(0.327, 45.307)	0.284
Obesity	3.42	(0.319, 36.561)	0.309
Education			
No formal education	1.00		
Basic	2.80	(0.692, 11.361)	0.148
Secondary	2.26	(0.552, 9.221)	0.257
Tertiary	0.46	(0.047, 4.587)	0.512
Occupation			
Government employee	1.00		
Non-gov't employee	0.07	(0.096, 0.574)	0.013
Trader	0.14	(0.018, 1.117)	0.064
Housewife	0.08	(0.005, 1.078)	0.057

Continued.

Variables	aOR	95% CI	P value
Smoking status			
No	1.00		
Yes	1.36	(0.177, 10.372)	0.769
Frequency of sex			
Once a week	1.00		
More than once a week	0.27	(0.053, 1.366)	0.114
Lost pregnancy			
No	1.00		
Yes	0.35	(0.022, 5.432)	0.455
Recurrent UTI			
No	1.00		
Yes	3.23	(0.512, 20.333)	0.212
ANC start month			
First month	1.00		
Third month	1.75	(0.613, 4.995)	0.295
Sixth month	2.01	(0.632, 6.412)	0.236
Gestational age (Trimester)			
First trimester	1.00		
Second trimester	0.50	(0.165, 1.526)	0.225
Third trimester	1.04	(0.326, 3.291)	0.951
Parity			
No Child	1.00		
1-2	1.44	(0.551, 3.759)	0.457
3 and above	2.24	(0.616, 8.120)	0.221

DISCUSSION

Asymptomatic bacteriuria is common during pregnancy. It is a condition in which the urine culture reveals a significant growth of pathogens greater than 100,000 CFU/mL but without symptoms of UTIs. The aim of this study was to determine the prevalence of uro-pathogens among pregnant women in the Ga West Municipality of the Greater Accra Region of Ghana. This study was also interested in the resistant pattern of the isolated pathogens and the factors associated with bacteriuria among pregnant women.

The prevalence of uro-pathogens was 15.1%. This consistent with a study conducted in Eastern Ethiopia in 2021 that sought to determine the prevalence bacterial uro-pathogens and their antimicrobial susceptibility patterns among pregnant women. The findings from that study revealed a prevalence rate of 15.5%.[18] However, the prevalent rate from the current study is lower compared to similar studies conducted in Central Ethiopia in 2017 that revealed a prevalence rate of 18.7%.[19] The plausible reason for this difference in prevalence could be due to the different periods in which these studies were conducted. Women who become pregnant between 2020 to 2024 may be considered to have adequate knowledge in UTI prevention compared to women who were pregnant prior to this period as a result of health promotion intervention on health issues such as food habits, urinary habits and sexual behaviour habits among pregnant women.[20]

The current study showed that Enterobacteriaceae family bacteria are the most common causes of ASB among pregnant women. In the present study, out of 22 isolates, *E. coli* was the most frequent causative organism (27.3%), followed by *Klebsiella* species (22.7%). Similar findings have been documented in Yemen, Australia, South Africa, Taiwan, India, and Egypt. However, a study conducted in Brunei revealed *Klebsiella* species as the most common organism followed by *E. coli*.[24-31]

The resistant patterns of *E. coli* were 33.3% to ceftriaxone, 37.5% to levofloxacin, 36.7% to cefuroxime and 31.3% to ampicillin. These resistant rates were lower compared to the findings of studies elsewhere. For example, as reported in North India, the resistant pattern of *E. coli* was 64.2% to ceftriaxone, 71.4% to cefuroxime and 88.4% to ampicillin.[32] It showed 48.63% resistant rate to levofloxacin.[33] However, gentamicin was the most effective drug against *E. coli* with sensitivity rate of 88.24% in this study. The relatively low resistant rate of *E. coli* to ceftriaxone, levofloxacin, cefuroxime and ampicillin and high susceptibility to gentamicin may imply that the usage of these antibiotics in treating urine infections is very strict. Nonetheless, urinary tract infections are not fatal compared to blood and respiratory tract infection and thus do not require urgent treatment.

This study also revealed that *Citrobacter koseri*, *Klebsiella* species and *Citrobacter freundii* were all 100% sensitive to amikacin, ceftriaxone and levofloxacin respectively. This finding is surprising because these antibiotics are considered to be among the best first-line antibiotic for uncomplicated UTI and are commonly prescribed in treating UTI among women in women.[34,35] As a result, it was expected that there will be some level of resistance to these antibiotics. It is possible that the recruited pregnant women in this study do not often take these antibiotics to treat UTI and therefore have not develop any form of resistance to them.

In general, the isolates showed resistant rate of 90.91% to cotrimoxazole and their resistance against nalidixic acid, nitrofurantoin and tetracycline was 81.82%. Similarly, the isolates showed resistant rate of 77.23% against gentamicin and amikacin. These general findings are consistent with other findings elsewhere. For example, a study conducted in Pakistan that sought to determine the antibiotic susceptibility pattern of uro-pathogens among outpatients showed a general resistant rate of 90.1% to nalidixic acid, 64.2% to gentamicin, 81.9% to nitrofurantoin and 64.2% to amikacin.[36] A systematic review also revealed a general resistant rate of 68.1% to cotrimoxazole.[37]

The impact of various factors such as body mass index, educational level, smoking status, frequency of sex, recurrent UTI, and parity on bacteriuria was also examined. However, the results did not reveal any statistically significant influence of these factors on bacteriuria. These findings contradict the findings of other studies which suggest a potential association between these factors and bacteriuria.[21-23] Further studies are therefore needed to ascertain the relationship between these risk factors and bacteriuria.

One main strength of the study is that the methods for culture and sensitivity testing on urine samples are internationally approved methods and the findings from these methods are reliable. However, it is important to acknowledge the limitations of the study when interpreting the results. The data was collected using a cross-sectional survey design, which does not allow for establishing causative relationships between outcomes and predictors. Like many other studies, this research did not account for all possible factors that may influence the prevalence of bacteriuria among pregnant women.

CONCLUSION

The research findings indicated a prevalence rate of 15.1% for asymptomatic bacteriuria (ASB) in pregnant women, with *E. coli* being the predominant strain identified. Gentamicin demonstrated the highest sensitivity, while cotrimoxazole exhibited the highest resistance among the antibiotics tested. Although variables such as age, BMI, educational attainment, smoking habits, sexual activity frequency, history of recurrent urinary tract infections, and gestational age were identified as potential factors associated with bacteriuria in pregnant women, these relationships did not reach statistical significance. It is recommended that a risk stratification protocol based on demographic and behavioural factors be developed to identify high-risk groups. This protocol should involve enhanced monitoring of younger pregnant women and those with lower socioeconomic status, as well as early discussions regarding preventive measures during antenatal care visits. Furthermore, personalized hygiene and lifestyle guidance should be incorporated into patient education sessions. Pregnant women should be advised to adhere to optimal hygiene practices and safe sexual behaviours, with a focus on the role of these practices in preventing uro-pathogen colonization. Preference should be given to antibiotics with established safety profiles for both the mother and the developing foetus.

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REFERENCES

1. Shaheen G, Akram M, Jabeen F, Ali Shah SM, Munir N, Daniyal M, et al. Therapeutic potential of medicinal plants for the management of urinary tract infection: A systematic review. Clin Exp Pharmacol Physiol. 2019;46(7):613-24.
   Szweda H, Jóźwik M. Urinary tract infections during pregnancy-an updated overview. Dev Period Med. 2016;20(4):263-72.
2. Matuszkiewicz-Rowińska J, Małyszko J, Wieliczko M. State of the art paper Urinary tract infections in pregnancy: old and new unresolved diagnostic and therapeutic problems. Arch Med Sci. 2015;11(1):67-77.
3. Srirangam SJ, Hickerton B, Van Cleynenbreugel B. Management of urinary calculi in pregnancy: a review. J Endourol. 2008;22(5):867-76.
4. Illamola SM, Amaeze OU, Krepkova L V, Birnbaum AK, Karanam A, Job KM, et al. Use of herbal medicine by pregnant women: What physicians need to know. Front Pharmacol. 2020;10:1483.
5. Getaneh T, Negesse A, Dessie G, Desta M, Tigabu A. Prevalence of urinary tract infection and its associated factors among pregnant women in ethiopia: a systematic review and meta-analysis. BioMed Res Inter. 2021;2021(1):6551526.

6. Biset S, Moges F, Endalamaw D, Eshetie S. Multi-drug resistant and extended-spectrum β-lactamases producing bacterial uropathogens among pregnant women in Northwest Ethiopia. Ann Clin Microbiol Antimicrob. 2020;19:1-9.
7. Kathuria K. Impact of maternal health and disease on neonatal outcome. In: Clinical Anesthesia for the Newborn and the Neonate. Springer; 2023:11-27.
8. Berti C, Agostoni C, Davanzo R, Hyppönen E, Isolauri E, Meltzer HM, et al. Early-life nutritional exposures and lifelong health: immediate and long-lasting impacts of probiotics, vitamin D, and breastfeeding. Nutr Rev. 2017;75(2):83-97.
9. Okojie RO, Omorokpe VO. A survey on urinary tract infection associated with two most common uropathogenic bacteria. Afr J Clin Exp Microbiol. 2018;19(3).
10. Navarro A, Sison JM, Puno R, Quizon T, Manio LJJ, Gopez J, et al. Reducing the incidence of pregnancy-related urinary tract infection by improving the knowledge and preventive practices of pregnant women. Eur J Obstet Gynecol Reprod Biol. 2019;241:88-93.
Kalinderi K, Delkos D, Kalinderis M, Athanasiadis A, Kalogiannidis I. Urinary tract infection during pregnancy: current concepts on a common multifaceted problem. J Obstet Gynaecol. 2018;38(4):448-53.
11. Lopez AR, Dzandu E, Amegayie SM, Andor C, Rufi T, Karikari JK. Asymptomatic bacteriuria among pregnant women attending Antenatal Clinic at the Akuapem North District of the Eastern Region of Ghana. Texila Int J Public Health. 2021;9(3):24-34.
12. Yadav K, Prakash S. Prevalence of asymptomatic bacteriuria during pregnancy at a tertiary care hospital of Province No. 2, Nepal. Tribhuvan Univ J Microbiol. 2019;6(2):32-8.
13. Nteziyaremye J, Iramiot SJ, Nekaka R, Musaba MW, Wandabwa J, Kisegerwa E, et al. Asymptomatic bacteriuria among pregnant women attending antenatal care at Mbale Hospital, Eastern Uganda. PLoS ONE. 2020;15(3):1-12.
14. Awoke N, Tekalign T, Teshome M, Lolaso T, Dendir G, Obsa MS. Bacterial Profile and asymptomatic bacteriuria among pregnant women in Africa: A systematic review and meta analysis. Clini Medi. 2021;37:100952.
15. Azami M, Jaafari Z, Masoumi M, Shohani M, Badfar G, Mahmudi L, et al. The etiology and prevalence of urinary tract infection and asymptomatic bacteriuria in pregnant women in Iran: a systematic review and meta-analysis. BMC Urol. 2019;19(1):43.
16. jerssa AW, Gadisa DA, Orjino TA. Prevalence of bacterial uropathogens and their antimicrobial susceptibility patterns among pregnant women in Eastern Ethiopia: hospital-based cross-sectional study. BMC Womens Health. 2021;21(1):291.
17. Gessese YA, Damessa DL, Amare MM, Bahta YH, Shifera AD, Tasew FS, et al. Urinary pathogenic bacterial profile, antibiogram of isolates and associated risk factors among pregnant women in Ambo town, Central Ethiopia: a cross-sectional study. Antimicrob Resist Infect Control. 2017;6(1):132.
18. Alidousti K. Effect of integrated Health Promotion Intervention and follow up on Health issues (clothing way, food habits, urinary habits, sexual behavior habits) Related to Urinary Tract Infection Among Pregnant women. A Randomized, Clinical Trial. J Prev Med Hyg. 2020;61(2):E194.
19. Labi A, Yawson A, Ganyaglo G, Newman M. Prevalence and associated risk factors of asymptomatic bacteriuria in ante-natal clients in a large teaching hospital in Ghana. Ghana Med J. 201;49(3):154.
20. Balachandran L, Jacob L, Al Awadhi R, Yahya LO, Catroon KM, Soundararajan LP, et al. Urinary tract infection in pregnancy and its effects on maternal and perinatal outcome: A retrospective study. Cureus. 2022;14(1).
21. Tchente Nguefack C, Okalla Ebongue C, Nouwe Chokotheu C, Ebong Ewougo C, Nana Njamen T, Mboudou E. Clinical presentation, risk factors and pathogens involved in bacteriuria of pregnant women attending antenatal clinic of 3 hospitals in a developing country: a cross sectional analytic study. BMC Pregn Childb. 2019;19(1):143.
22. Al-Ofairi BA, Edrees WH, Al-Hadheq AA, Al-Jendy AS, Alrahabi LM, Al-Ruwaisis AM, et al. Gram-negative bacteria in some clinical specimens and their antibiotics resistance profiles, Sana'a, Yemen. Electron J Univ Aden Basic Appl Sci. 2024;5(1):86-94.
23. Kamenski G, Wagner G, Zehetmayer S, Fink W, Spiegel W, Hoffmann K. Antibacterial resistances in uncomplicated urinary tract infections in women: ECO·SENS II data from primary health care in Austria. BMC Infect Dis. 2012;12(1):222.
24. Renuart AJ, Goldfarb DM, Mokomane M, Tawanana EO, Narasimhamurthy M, Steenhoff AP, et al. Microbiology of Urinary Tract Infections in Gaborone, Botswana. Thumbikat P, editor. PLoS ONE. 2013;8(3):e57776.
Chen LF, Chiu CT, Lo JY, Tsai SY, Weng LC, Anderson DJ, et al. Clinical characteristics and antimicrobial susceptibility pattern of hospitalised patients with community-acquired urinary tract infections at a regional hospital in Taiwan. Healthc Infect. 2014;19(1):20-5.
25. Rosana Y, Ocviyanti D, Halim M, Harlinda FY, Amran R, Akbar W, et al. Urinary tract infections among indonesian pregnant women and its susceptibility pattern. Infect Dis Obstet Gynecol. 2020;2020(1):1-7.
26. Rohini UV, Reddy GS, Kandati J, Ponugoti M. Prevalence and associate risk factors of asymptomatic bacteriuria in pregnancy with bacterial pathogens and their antimicrobial

susceptibility in a tertiary care hospital. Int J Reprod Contracept Obstet Gynecol. 2017;6(2):558.
27. Hansen C, Andrade SE, Freiman H, Dublin S, Haffenreffer K, Cooper WO, et al. Trimethoprim-sulfonamide use during the first trimester of pregnancy and the risk of congenital anomalies: sulfonamides and risk of congenital anomalies. Pharmacoepidemiol Drug Saf. 2016;25(2):170-8.
28. Muharram SH, Ghazali SNB, Yaakub HR, Abiola O. A preliminary assessment of asymptomatic bacteriuria of pregnancy in brunei darussalam. Malays J Med Sci MJMS. 2014;21(2):34-9.
Niranjan V, Malini A. Antimicrobial resistance pattern in Escherichia coli causing urinary tract infection among inpatients. Indian J Med Res. 2014;139(6):945-8.
29. Wang S, Zhao S, Zhou Y, Jin S, Ye T, Pan X. Antibiotic resistance spectrum of E. coli strains from different samples and age-grouped patients: a 10-year retrospective study. BMJ Open. 2023;13(4):e067490.
30. Dwivedi R, Ofstedal J. What is the best first-line antibiotic for uncomplicated UTI in women? Evid-Based Pract. 2017;20(10):11-2.
31. Sharma S, Sharma V, Boddepalli D. A retrospective study to evaluate the pattern of antibiotics prescribed in female patients with urinary tract infection (UTI): A tertiary care centre study. Int J Life Sci Biotechnol Pharma Res. 2023;12(4):1200-3.
32. Muhammad A, Khan SN, Ali N, Rehman MU, Ali I. Prevalence and antibiotic susceptibility pattern of uropathogens in outpatients at a tertiary care hospital. New Microbes New Infect. 2020;36:100716.
33. Rezaei-Tavirani M, Ghafourian S, Sayehmiri F, Pakzad R, Safiri S, Pakzad I. Prevalence of cotrimoxazole resistance uropathogenic bacteria in Iran: a systematic review and meta-analysis. Arch Clin Infect Dis. 2018;13(5).

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