

Asymptomatic Bacteriuria among Pregnant Women Attending Antenatal Clinic at the Akuapem North District of the Eastern Region of Ghana

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Abstract

Asymptomatic bacteriuria is a condition in which urine culture reveals the presence of more than 10^5 bacteria per millilitre but without the patient showing signs and symptoms of urinary tract infection (UTI). In many of the health care facilities in Ghana, routine screening for ASB among pregnant woman is not done despite overwhelming evidence clearly demonstrating its benefits in preventing UTI and the associated adverse pregnancy outcome. It is a common problem in pregnant women, which usually results in maternal and fetal complications. The majority of the participant were in the age range of 25 years to 34 years, and all the participants had basic education. Out of the 134 sterile urine samples cultured, 11 of the participants had bacteria isolated from their urine, given a prevalence of 8.2%. *Escherichia coli* were 63.6%, Nitrofurantoin was 81.8% sensitive to all bacteria isolated, and Cotrimoxazole was the most resistant antibiotic with 72.7%. Factors associated with ASB in Akuapem North District were toilet facility, multiple pregnancy, and any medical condition, which were statistically significant at the bivariate analysis level. After adjusting these factors with the multiple logistics regression, only multiple pregnancy was statistically significant. The study revealed an 8.2% prevalence of ASB among pregnant women with *E. coli*, the predominate bacteria with 63.6%. Nitrofurantoin, 81.8% sensitive, and Cotrimoxazole was the most resistant antibiotics with 72.7%. Multiple pregnancy was associated with Asymptomatic bacteriuria among pregnant women at Akuapem North District.

Keywords: Asymptomatic Bacteriuria, Pregnant Women, Urine Culture, Urinary Tract Infection.

Introduction

Asymptomatic bacteriuria is a condition in which urine culture reveals the presence of more than 10^5 colony forming unite of bacteria per millilitre (CFU/mL), but the client is showing no signs and symptoms of urinary tract infection [1].

An early study by [2] revealed that the apparent reduction in immunity of pregnant women appears to encourage the growth of both

commensal and pathogenic microorganisms. During pregnancy, there is a physiological increase in plasma volume and a decrease in urine concentration up to about 70% that developed glycosuria which encourages bacteria growth in the urine [3]. Again, in their study, although all women are prone to the development of UTIs, pregnant women are at increased risk because of the numerous changes in the woman's body caused by pregnancy. In support of [3] findings, [4] also came out that

pregnant women have hormonal and anatomical changes that contribute to ureteral dilatation and urinary stasis. These changes include shortness of the urethra and difficulty with hygiene due to a distended belly that increases UTI frequency in pregnant women.

To [5], women with Asymptomatic bacteriuria show a variable degree of the local urinary, immune response. This is almost one-third to half of the elderly women with Asymptomatic bacteriuria having elevated antibody levels compared with non-bacteriuria women. Further findings of [5] revealed that Asymptomatic bacteriuria, which is urinary cytokines, has been shown to be more frequently present in women when they become pregnant. In Africa, [6] reported that the prevalence of Asymptomatic bacteriuria among pregnant women and their effect on the reduction in immunity has increased risk factors such as infection of the foetus.

In Ghana, [7] reported that the prevalence of Asymptomatic bacteriuria was associated with sexual activity during pregnancy but not with sexual frequency. [7] also disagree that urinary infection does not affect the foetus being carried but reported that the commonest organism isolated was *Enterococcus spp*, although the *Enterobacteriaceae* formed the majority of isolated organisms. [7] also contended that nitrofurantoin was the antibiotic with the highest sensitivity to all the isolated organisms.” [8] and [9] in their studies mentioned that pregnancy increases the progression from asymptomatic to symptomatic bacteriuria, leading to pyelonephritis and obstetric outcomes such as prematurity, low birth weight, and higher foetal mortality rates. [8] again added that the adverse

effects of Asymptomatic undiagnosed bacteriuria on mother and child have made researchers to recommend routine urine culture for all pregnant women attending the antenatal clinic to prevent mother and child from any form of complication that may arise due to infection. Briefly, extensive work has not been done when it comes to Asymptomatic bacteriuria and its associated factors in the study area of Akuapem North District. Therefore, this study aims to screen for Asymptomatic bacteriuria and its antibiotic susceptibility patterns of the isolated bacteria among antenatal women that visited the health care facilities at the Akuapem North District.

Materials and Methods

The research employed a cross-sectional study between May to June 2019 to collect both qualitative and quantitative data on pregnant women attending antenatal clinics at Akuapem North District.

Study Site

The study was conducted at Akuapem North District, which is located at the south-eastern part of the Eastern Region, which is about 58 km from Accra, the capital city of Ghana. The Akuapem North Municipal shares boundaries to the northeast with Yilo Krobo, north with New Jauben Municipal, southeast with Dangbe West, southwest with Akuapem South District, and in the west with Suhum-Kraboa-Coaltar District. The district covers a land area of about 450 sq. km representing 2.3 percent of the total area of the Eastern Region and has about 230 settlements [9].

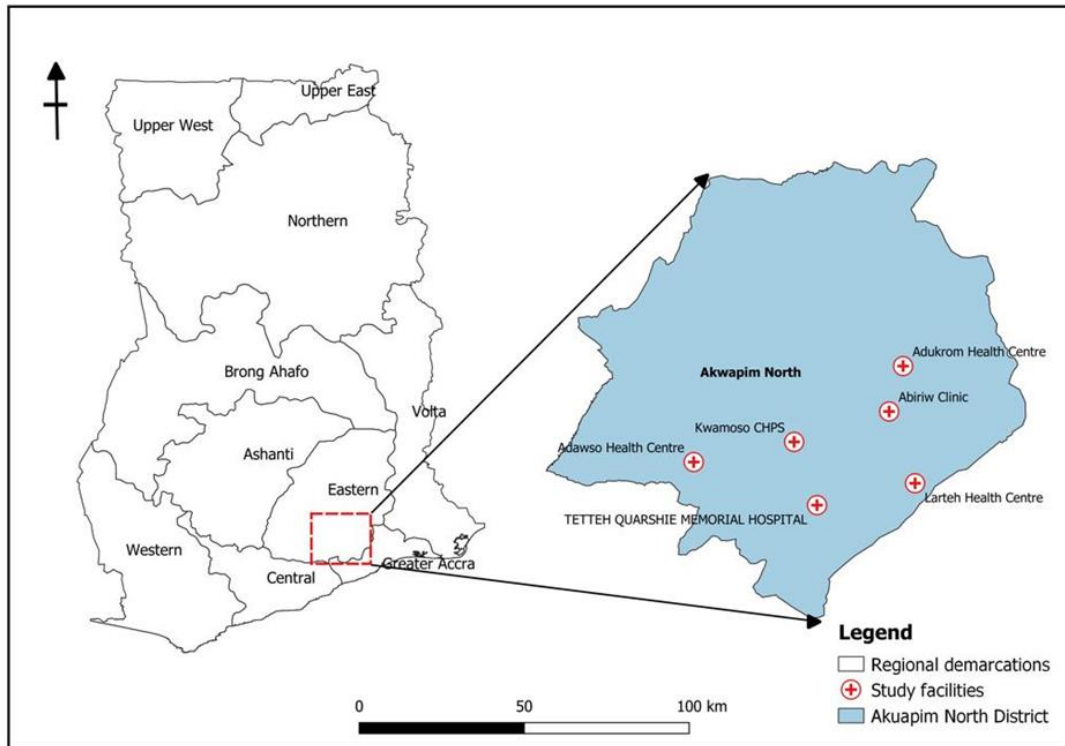


Figure 1. Map of Akuapem North

Study Population

The study population was all pregnant women who were attending antenatal clinics at any of the six selected health facilities at Akuapem North District from May to June 2019.

Sampling

Sample Size Determination

The sample size was calculated from Cochran's formula.

$$n = Z^2 p (1 - p) / e^2$$

Where n is the minimum sample size, Z is the standard z score that corresponds with a 95% confidence interval, which is 1.96, p is the proportion of pregnant women with ASB and e is the allowable error margin set at 5%.

$$n = Z^2 p (1 - p) / e^2$$

this implies that,

Z= 95% CI is 1.96

p = proportion of pregnant women with Asymptomatic bacteriuria in Akuapem North District. In Akuapem North District, the proportion of is u Figure 2: Map of Akuapem

North known but a similar study was carried out at Komfo Anokye with the prevalence of 7.3% [10] was used for the calculation of the minimum sample size for the study.

$$p=7.3\% =0.073$$

$$e=5\% =0.05$$

$$n = Z^2 p (1 - p) / e^2$$

$$=1.96^2 * 0.073 (1-0.073)/0.05^2 =3.8416 * 0.073 (0.927)/0.0025$$

$$=3.8416 * 0.073 (0.927)/0.0025 = 3.8416 * 0.067671/0.0025$$

$$= 3.8416 * 0.067671/0.0025$$

$$=0.2599649136/0.0025$$

$$=103.985 \sim 104 \text{ participants.}$$

Sampling Method

A five-year antenatal attendance book was used to calculate the mean attendance for each of the 23 health facilities in the district. Six health facilities were selected for the study based on the highest number of antenatal attendances. Samples were proportionately allocated to the six health facilities based on their five-year attendance. Those who consented to be part of the study had their urine specimens screened

with the routine urine examination test to exclude those with protein, leucocyte, nitrate, glucose, and pus cells in their urine. Based on the number that was negative for protein, leucocyte and nitrate, and pus cells in their urine, the pregnant women were randomly selected by picking YES or NO, which was written on pieces of paper, folded, and put into a bowl. All those who picked YES were selected for the study. In instances where only a pregnant woman's result was negative on a particular day, that person was selected automatically for the study. The procedure was repeated on another antenatal day for those who were not already screened until they require a number from each stratum was gotten.

Selection of Participants

Routine urine examination was used as a baseline after they had satisfied the inclusion criteria and consented to be part of the study. Urine specimens from the pregnant women were collected and screened for the presence of protein, nitrate, glucose, leucocytes, and pus cell. All those who were negative after the routine urine examination test were randomly selected by picking YES or NO to give an equal chance of been included into the study.

Data Collection Techniques and Tools

Review of Patients Records

Maternal and child health record book (antenatal book) was used to retrieve information on clinical and pregnancy history such as gestational age, previous delivery with any birth defects, any medical condition, and outcome of the previous delivery.

Laboratory Analysis

Culture and Antimicrobial Susceptibility

Each urine specimen was well mixed by swirling the container. A sample was plated (cultured) in a labelled petri dishes containing a media of Cystine Lactose Electrolyte Deficient (CLED) and 5% sheep blood agar media for the primary isolation of uropathogen using a sterile

calibrated wire loop (0.002 mL) to inoculate a loopful of urine onto a half plate of each of the agars.

The culture plates were incubated between 35°C-37°C aerobically for 18-24 hours. When there is bacterial growth after 18-24 hours of incubation morphological identification, biochemical test, colony count, and sensitivity were performed.

Data Analysis

The data was analysed using STATA software version 15.

Results and Discussion

134 urine specimens were analyzed from pregnant women in six selected health facilities in the Akuapem North District who came for their antenatal clinic during the period of the study. Routine urine examination was performed, and those pregnant women whose results were negative for protein, leucocytes, nitrite, glucose, and pus cells less than 4 HPF and consented were enrolled in the study. A microbiological culture method was performed to determine the proportion of Asymptomatic bacteriuria among pregnant women at Akuapem North District. The ages of participants ranged from a minimum of 17 years to 43 years with an average age of 29.9 years (SD \pm 6.3). The majority of the pregnant women, 72 representing 53.7%, were in the age range of 25-34 years, and 24.6% pregnant women were above 35 years.

All participants and the fathers of the inborn babies (foetus) had some level of education. 73 pregnant women representing 54.5%, had basic education, while 79 representing 58.9% of the baby's (foetus) father, had advanced education. More than 78% of the participants were working at the time of the study, but only 17, representing 12.7%, earned a monthly income above one thousand Ghana cedis. More than 50% of the pregnant woman were married, 57(42.5%) were co-habiting, and the remaining 5 representing 3.8%, were single. 55 of the respondents representing 41.0%, were yet to have their first

child/twins, and 18 representing 13.5%, had a total family size of more than five. The prevalence of Asymptomatic bacteriuria among the study sample was 8.2% (4.2%-14.2%).

In this study, urine culture and sensitivity, which is the gold standard, was randomly ran for 134 pregnant women who visited any of the six selected health facilities in the Akuapem North District. 134 pregnant women were screened with the current technique routine urine examination that is normally employed at these health facilities. A routine urine examination method was performed, and the results for those who were negative were assumed free from

bacterial infection. However, a sterile urine container was given to all those participants to produce another urine specimen for culturing. 11 turned up with bacteria growth representing 8.2% CI (4.2-14.2) that were negative from the earlier test performed. This, therefore, meant that they actually had Asymptomatic bacteriuria. Figure 2 below gives the pictorial view of the isolated bacteria. In order to check how significant this proportion of the number of pregnant women who actually had Asymptomatic bacteriuria a binomial test was run as shown in Table 1.

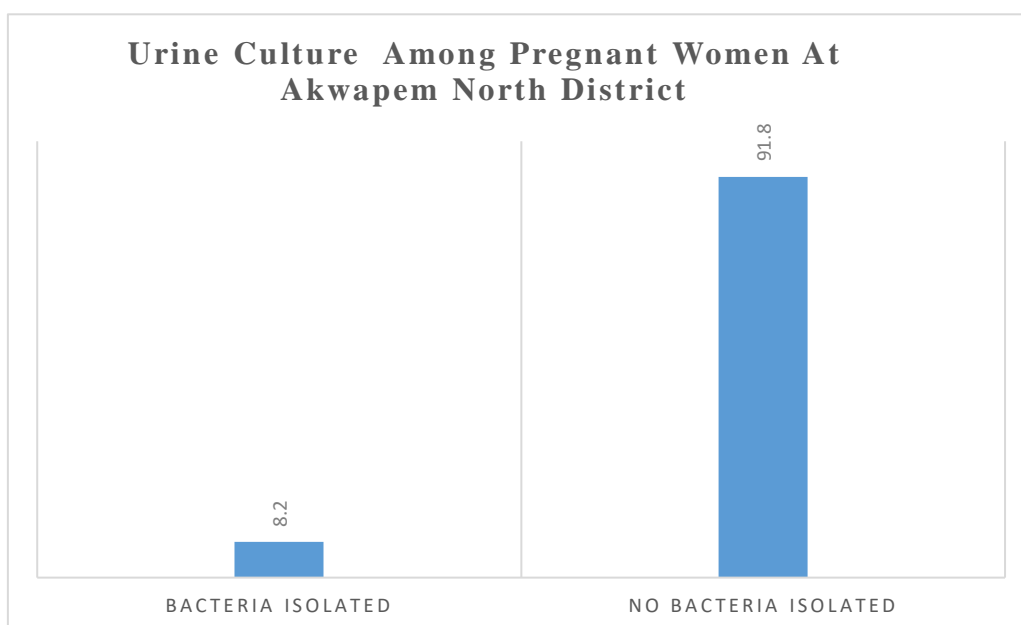


Figure 2. Urine Culture among Pregnant Women at Akuapem North District

Table 1. Binomial Test for Sample Proportion

		Category	N	Observed Prop.	Test Prop.	P-value
Bacteria growth	Group 1	No bacteria growth	123	0.918	.999	0.000 ^a
	Group 2	Bacteria Growth	11	0.082	-	-
	Total		134	1.000	-	-

a. Alternative hypothesis states that the proportion of cases in the first group < .999

The Binomial Test in Table 1 revealed that the proportion (0.082) of pregnant women who were really having Asymptomatic bacteriuria was very significant since the p-value (0.000) which is less than 0.05. This, therefore, means that, out of every 1000 pregnant women who were

initially declared to be free from urinary tract infection Asymptomatic bacteriuria, 82 of them were actually having Asymptomatic bacteriuria at Akuapem North District at 95% confidence level.

Table 2. Isolated Bacteria from Asymptomatic Bacteriuria

Bacteria isolated	<i>E. coli</i>	<i>Klebsiella spp</i>	<i>Proteus spp</i>	<i>Staph. aureus</i>	<i>Total</i>
	n (%)	n (%)	n (%)	n (%)	n (%)
Total bacteria isolated	7(63.6)	2(18.2)	1(9.1)	1(9.1)	11(100)
Antibiotics					
Ampicillin					
Sensitive	5 (71.4)	2 (100)	0 (0)	0 (0)	7 (63.6)
Resistant	2 (28.6)	0 (0)	1 (100)	1 (100)	4 (36.4)
Cotrimoxazole					
Sensitive	2 (28.6)	0 (0)	0 (0)	1 (100)	3 (27.3)
Resistant	5 (71.4)	2 (100)	1 (100)	0 (0)	8 (72.7)
Cefuroxime					
Sensitive	4 (57.1)	1 (50)	0 (0)	0 (0)	5 (45.5)
Resistant	3 (42.9)	1 (50)	1 (100)	1 (100)	6 (54.6)
Gentamicin					
Sensitive	6 (85.7)	1 (50)	1 (100)	0 (0)	8 (72.7)
Resistant	1 (14.3)	1 (50)	0 (0)	1 (100)	3 (27.3)
Nalidixic Acid					
Sensitive	5 (71.4)	1 (50)	1 (100)	0 (0)	7 (63.6)
Resistant	2 (28.6)	1 (50)	0 (0)	1 (100)	4 (36.4)
Nitrofurantoin					
Sensitive	5 (71.4)	2 (100)	1 (100)	1 (100)	9 (81.8)
Resistant	2 (28.6)	0 (0)	0 (0)	0 (0)	2 (18.2)
Pipemidic Acid					
Sensitive	4 (57.1)	1 (50)	1 (100)	1 (100)	7 (63.6)
Resistant	3 (42.9)	1 (50)	0 (0)	0 (0)	4 (36.4)
Tetracycline					
Sensitive	4 (57.1)	2 (100)	0 (0)	0 (0)	6 (54.6)
Resistant	3 (42.9)	0 (0)	1 (100)	1 (100)	5 (45.5)

Asymptomatic bacteriuria pregnant women at Akuapem Mampong and its antimicrobial susceptibility pattern.

Source: Fieldwork, 2019

Table 2 showed the antimicrobial susceptibility patterns of 4 bacteria isolated from 11 pregnant women at Akuapem North District. The bacteria were three Gram-negatives namely *Escherichia coli*, *Klebsiella spp* and *Proteus spp*, and *Staphylococcus aureus* as the only Gram-positive bacteria isolated from the study. Also, from Table 2 above, the study showed that *E. coli* was the highest bacteria isolated from seven pregnant women representing 63.6%, followed by *Klebsiella spp* which was isolated from 2 pregnant women representing 18.2%. The other two bacteria were *Proteus spp* and

Staphylococcus aureus, which were isolated from two pregnant women representing 9.1% each.

From the study, Nitrofurantoin was the most effective antibiotic, which was sensitive to 81.8% of the bacteria isolated, followed by Gentamicin 72.7% sensitive. Cotrimoxazole was the highest resistant antibiotic to the isolated four (4) bacteria among the pregnant women in Akuapem North District, representing 72.7%. Tetracycline was the second antibiotic with a resistance of 45.5%.

Table3. Multiple Logistic Regression Results for Factors Associated with Asymptomatic Bacteriuria

Variables	Bacteria		Unadjusted Model		Adjusted Model	
	No Growth	Growth	cOR (95% CI)	P-value	aOR (95% CI)	P-value
Toilet facility						
Private	94 (94.95)	5 (5.05)	1.00(reference)	0.04	1.00(reference)	0.06
Public	29 (82.86)	6 (17.14)	3.9(1.1-13.8)		4.03(0.93-17.5)	
Multiple pregnancy						
No	118(93.6)	8(6.4)	1.00(reference)	0.01	1.00(reference)	0.01
Yes	5(62.5)	3(37.5)	8.85(1.7-44.2)		9.52(1.7-51.9)	
Any medical condition						
No	115(93.5)	8(6.5)	1.00(reference)	0.03	1.00(reference)	0.09
Yes	8(72.7)	3(27.3)	5.4(1.19-24.5)		2.0(0.26-16.9)	

cOR-crude odds ratio aOR-adjusted odd ratio CI-confidence interval.

Multiple logistic regression analysis was conducted on all the associated factors that were statistically significant at 95% CI and P-value \leq 0.05 at the bivariate level. These factors were toilet facility, multiple pregnancies, and any medical condition. Out of the three associated factors that were significantly associated with asymptomatic bacteriuria in the bivariate analysis, only one was statistically significant and strongly associated with the development of asymptomatic bacteriuria at the multiple logistic regression analysis levels (P-value \leq 0.05). This is shown on Table 3 above.

The study investigated the proportion of asymptomatic bacteriuria among a study population of one 134 pregnant women from six selected health facilities in Akuapem North District during a period of May to July 2019. Urine specimens were cultured from pregnant women whose initial results with routine urine examination were negative for protein, nitrite, leucocytes, and pus cells less than 5/HPF. The results of the study showed that 11 out of one hundred and thirty-four 134 pregnant women had had ASB giving a proportion of 8.2% (4.3-14.6). The prevalence is almost close to similar work done by [11]. This study is in agreement with what several researchers said about the prevalence of asymptomatic bacteriuria among pregnant women that is from 2.5% to over 10% [12].

In contrast to this study, the study done in Nigeria by [13] had a much higher prevalence of 86.6%, which may be due to the difference geographical area of the study population or the screening method used in selecting the participants. Asymptomatic bacteriuria rarely causes serious problems however, in pregnancy, if this condition is left untreated, more than 30% of the pregnant women will develop serious complications [14].

From the Binomial Test in Table 1 show that the proportion 11/134 (0.082) of pregnant women who were really having asymptomatic bacteriuria was very significant since the p-value (<0.001) is less than 0.05. This, therefore, means that, out of every 1000 pregnant women who were initially declared free from urinary tract infection with the routine urine examination technique used in Akuapem North District among the participants, 82 will have asymptomatic bacteriuria, and out of that, more than 25 of them will develop serious complications. Some of these consequences of asymptomatic untreated bacteriuria in pregnant women may lead to pyelonephritis, low birth weight, premature labor, eclampsia, premature rupture of the membrane, mental retardation, fatal death, pregnancy-induced hypertension, anaemia [15]. This can be a great worry to families since more resources will be spent to treat these conditions or even spend the whole

lifetime looking after a human being from infancy through adulthood to old age if he/ she has developed a mental condition. Life can also be lost since this condition can result into fatality on the part of either child or mother.

According to [16], in Turkey, the prevalence of Asymptomatic bacteriuria was 8.5% which has a difference of 0.3% from this study. Similar studies were conducted in the same country Ghana but in different geographical regions. These studies were conducted in Ashanti Region at Komfo Anokye Teaching Hospital, Kumasi by [10] and had a prevalence of 7.2%. At Korle-bu Teaching Hospital in the Greater Accra Region, the capital city of Ghana, the prevalence of Asymptomatic bacteriuria was 5.5% [7]. This research was also carried out at Akuapem North District from May-July, 2019 in the Eastern Region of Ghana and had a result of 8.2% prevalence of Asymptomatic bacteriuria among pregnant women. These variations in prevalence can be attributed to several factors, some of them are sociodemographic factors, environmental factors, clinical/pregnancy history, and health facilities. Four different types of bacteria were isolated from the study. These were *E. coli* 7(63.6%), *Klebsiella spp* 2(18.1%), *Proteus spp* 1(9.1%) and *Staphylococcus aureus* 1(9.1%).

Comparing the study to similar studies done in Ghana, the commonest bacteria isolated was in line with the one conducted by [10] at Komfo Anokye Teaching Hospital, Kumasi, which had *E. coli*- 6(37.5%). In Greater Accra Region, [7] had *Enterococcus spp* of 4(26.7%) as the common bacteria isolated at the Korle-Bu Teaching Hospital. Studies were done in different countries all confirmed *E coli* to be the most causative bacteria causing Asymptomatic bacteriuria among pregnant women. This can be affirmed by [17] in Babol city, [18], Jahrom, [19] in Tanzania [20] in Yemen [21] in Gorgan, and all had *E. coli* as the most causative bacteria in their studies. This is consistent with the work done at Akuapem North District. Antibiotics are among the most frequently prescribed types of medication during pregnancy and lactation [22].

The study showed the antimicrobial susceptibility patterns of four different types of bacteria isolated from eleven pregnant women. The bacteria were three Gram-negatives: *Escherichia coli*, *Klebsiella spp* and *Proteus spp*, and *Staphylococcus aureus*, the only Gram-positive bacteria isolated from the study.

Table 2 showed *E. coli* was the most predominant bacteria isolated from 7 pregnant women representing 63.6%, followed by *Klebsiella spp*. it was isolated from 2 pregnant women representing 18.2%. The other two bacteria were *Proteus spp* and *Staphylococcus aureus*. *Proteus spp* was isolated from one pregnant woman, and *Staphylococcus aureus* was from another pregnant woman representing 9.1% each.

From the study, Nitrofurantoin was the most effective antibiotic, which was 81.8% sensitive to the bacteria isolated. This was in agreement to the study done by [7] and went further to explain that antibiotics is not commonly used for the treatment of UTI in Ghana; therefore, their abuse is limited. From this study, Gentamicin was 72.7% sensitive to the isolated bacteria, and from the researcher's point of view, this antibiotic is an injectable; therefore, the use of it might be limited unless prescribed by a clinician or a pharmacist and also the pain in injecting one's self with a needle.

Cotrimoxazole was the highest resistant antibiotic to the isolated four bacteria among the pregnant women in Akuapem North District, representing 72.7%. It is very common in Ghana, and both the injection and the tablet, so the abuse of it is high. Cefuroxime is also gradually becoming resistant since this is given to pregnant women to treat urinary tract infections [23]. When routine urine examination results suggest urinary tract infection, it must be confirmed by culture and sensitivity to know its susceptibility pattern and epidemiology. Epidemiological studies carried out among pregnant women in different populations worldwide have identified a diverse range of factors for asymptomatic bacteriuria [24]. The result of this study showed

that there were no statistically significant associations with the development of Asymptomatic bacteriuria between most of the factors. [7] reported, the prevalence of Asymptomatic bacteriuria was associated with sexual activity during pregnancy, but not with sexual frequency, their finding affirmed in the current study.

The frequency of sexual intercourse per week was not statistically significant (p-value 0.353). At the bivariate level, only four of these factors were statistically significant at 95% CI and P-value ≤ 0.05 . The results from the analysis indicate that toilet kind (p-value = 0.03), multiple pregnancy (p-value = 0.01), family history of medical condition (p-value = 0.04) and UTI previous experience (p-value= 0.03) were associated with Asymptomatic bacteriuria. This means that there is a possibility of pregnant women having Asymptomatic bacteriuria based on these factors.

According to [25], women who have many children before the present pregnancy and it has been reported that multiparity is associated with Asymptomatic bacteriuria. In this study, the number of births was not statistically significant, but it was multiple pregnancies that were strongly associated with 9.5 folds greater odds of getting Asymptomatic bacteriuria compared to those with no multiple pregnancies in both bivariate and multivariate analysis 8.9 and 9.2 respectively.

Conclusion

The prevalence of asymptomatic bacteriuria among pregnant women is 8.2 (4.3%-14-6%) at Akuapem North District. *E. coli* was the most

predominate bacteria isolated with 63.6%. Quantitative urine culture is the ideal test for the detection of asymptomatic bacteriuria.

The culture method helps to identify the bacteria and per its susceptibility pattern in order to reduce the antibiotics resistance, which has now become a public health problem globally. Early detection and treatment are essential to safeguard the health of the mother and fetus. In this study, Nitrofurantoin was the most sensitive with a percentage of 81.8, and Cotrimoxazole was the most resistant of 72.7%. Screening of Asymptomatic bacteriuria with the gold standard will help in knowing the bacteria causing the infection and deciding the best choice of antibiotics treatment.

Recommendation

Medical laboratories in the district need to be upgraded to enable them to screen for Asymptomatic bacteriuria for all pregnant women with a more sensitive technique instead of the routine urine examination, which is not sensitive in detecting Asymptomatic bacteriuria among pregnant women.

Conflict of Interest

The authors declare that they have no competing interests.

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