Original Research Article

Asymptomatic Bacteriuria among Pregnant Women Attending Antenatal Care at the Korle-Bu Teaching Hospital Accra, Ghana: A cross-sectional study

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ABSTRACT

Background: The significance of asymptomatic bacteriuria (ASB) relates to its potential to cause acute pyelonephritis, preterm labour and preterm rupture of the membranes. Additionally, it has been associated with clinical conditions such as anemia, preterm birth, low birth weight and perinatal mortality**.**

Aim: This study therefore determined the prevalence of ASB among pregnant women attending antenatal clinic.

Materials and Methods: A cross-sectional study using convenient sampling method was used to recruit 200 pregnant women attending antenatal care at the Korle-Bu Teaching Hospital (KBTH) from January – April, 2014. Bacteriological, urine chemistry and routine urine analyses as well as antibiotic susceptibility profile of bacterial isolates from mid-stream urine samples of pregnant women were carried out using appropriate standard methods. Variables were reported in mean, standard deviation, percentages and bar graph. Chi square test was used to establish statistical difference and association between variables where p-value <0.05 was considered statistically significant.

Results: Out of the total participants, 23 had asymptomatic bacteriuria but no prevalence of ASB was found among Muslims. The association between marital status and prevalence of ASB was significant (Pearson chi2 = 4.88, p-value = 0.027). Five bacterial isolates were obtained with *Escherichia coli* (43.6%) being the most prevalent organism. There were more negative reactions than positive reactions with regards to nitrite and leukocyte esterase determination. Both gram positive and negative isolates recorded high susceptibility to Gentamicin and Norfloxacin. However, Ciprofloxacin showed a high rate of resistance to only gram negative isolates whiles Chloramphenicol, Ampicillin and Amoxillin showed high resistance to gram positive isolates.

Conclusions: The overall prevalence of asymptomatic bacteriuria was 11.5% among the referral pregnant women attending KBTH with *Escherichia coli* being the most prevalent organism whiles the most susceptible antibiotics were Gentamicin and Norfloxacin.

1. INTRODUCTION

Urinary tract infections (UTI's) are diseases that affect any part of the urinary system being it the kidney, Ureters, bladder or the Urethra (Kriplain, Bukshee , & Rafan, 1993). Most UTI's affect the lower urinary tract (bladder and Urethra) before they complicate to the upper tract level (Mezue, Ofong, Nmezi, & Ugochukwu-Obi, 2006). Urinary Tract Infections are a common problem encountered in pregnancy due to the morphological and physiological changes that take place in the genitourinary tract (Sharma, 1990). It is of two types, symptomatic and asymptomatic (Akinloye, Ogbolu, Akinloye, & Alli, 2006). Asymptomatic bacteriuria refers to a condition in which urine culture reveals a significant growth of pathogens greater than 10^5 bacteria per milliliter in the absence of urinary symptoms (Lavanya & Jogalakshmi, 2008).

Urinary Tract Infections affect all age group, but women particularly pregnant women are more susceptible than men due to their pregnancy condition and anatomically short urethra which is easily contaminated by fecal flora (Gupta, Sahm, Mayfield, & Stamm, 2001). A bacterium during pregnancy has a greater propensity of progressing to pyelonephritis due to the following; reduction of glycogen secretion to the intracellular cavity of the vagina (Patterson & Andriole, 1997), relaxation of muscles of the ureters (Aboderin, Ako-Nai, Zailani, Ajayi, & Adedosu, 2004) which causes backward flow of urine and the cortisol production from progesterone secretion (Maclean, 1997).

The significance of ASB lies in its potential to cause acute pyelonephritis, preterm labour and preterm rupture of the membranes, other clinical condition includes; anemia, preterm birth, low birth weight and perinatal mortality (J. Akerele, Abhulimen, & Okonofua, 2001; Patterson & Andriole, 1997). A study carried out on ASB showed a prevalence between 2-7% (Okpere, 2003) but may be as high as 10% in high risk population (Kacmaz, Cakir, Aksoy, & Biri 2006). Furthermore, prevalence of ASB conditions may be as twice as common in pregnant women with sickle cell trait and three times as common in pregnant women with diabetic mellitus status (Kiningham, 1993). Studies done so far show that the prevalence rate of ASB in developing countries is higher than that in the developed states (Hooton , Winter , Tiu , & Stamm 1995).

A hospital based study carried out in some developed states including Canada showed a prevalence rate of 4-7% as compared to that of developing countries like Nigeria (i.e. Benin City and Sagamu) and Ethiopia. In Ghana, a study conducted in Komfo Anokye Teaching Hospital (KATH) and University of Cape Coast (UCC) hospital showed prevalence rates of 7.3% and 56.5% respectively (P. Akerele, Abhuliren, & Okonofua, 2001.; A. Alemu *et al.*, 2013; A. Boye e*t al.*, 2012; Turpin, Minkah, Danso, & Frimpong, 2007). Another report also showed that ASB occurs between 5-9% for both non-pregnant and pregnant women and if left untreated, can progress to symptomatic UTI's including acute cystitis and pyelonephritis; this progress to symptomatic UTI's is likely to be more in pregnant women than non-pregnant women. However, other conditions that increase the incidence include low socio-economic status, grand multi-parity and advance in age. A recommendation was made by the Infectious Diseases Society of America that there is a need to screen and treat all positive cultures during pregnancy. The study therefore determined the prevalence of ASB (Asymptomatic bacteriuria) in pregnant women attending antenatal clinic at the Korle-Bu Teaching Hospital. The research work also went ahead to ascertain the antibiotic susceptibility patterns of these significant bacteriuria.

2. MATERIAL AND METHODS

2.1 Study design / Study site

A cross-sectional study design was carried out to recruit pregnant women from January to April 2014 at the Obstetrics and Gynecology Department of Korle-Bu Teaching Hospital (KBTH). Korle-Bu Teaching Hospital is a premier health care facility in Ghana, it's one of the tertiary hospitals in the country and is located in the Accra metropolis in the Greater Accra region of Ghana.

2.2 Study participants/ Eligibility criteria

A total of 200 pregnant women attending antenatal clinic at KBTH within the study period were recruited using convenient sampling method. Pregnant women within the ages of 15-45years were included in this study, however, participants with signs and symptoms of Urinary tract infections (UTI's), kidney diseases, diabetes, urological surgery, carcinoma and spinal cord injuries were excluded.

2.3 Data Collection instrument and method

2.3.1 Questionnaire

Close – ended structured questionnaires were administered to the participants to obtain information on age, marital status, level of education, area of residence, parity, gestational age, gravidity, body mass index, blood pressure, hemoglobin level, religion and many other demographic characteristics.

2.3.2 Urine Sample Collection and Processing

Study participants after completing the interview were given labelled sterile universal containers by the interviewer and counselled on how to collect midstream urine. Approximately 15mls of urine were collected from each participant. The urine samples were transported immediately on ice to the Central laboratory, Department of Microbiology, KBTH for processing within four hours of collection to ensure that the pathogenic organisms present in the urine were isolated and also to avoid the possible proliferation of the pathogenic organisms.

The samples were subjected to routine microscopy and culture, the microscopy involved examining centrifuged urine for the presence of pus cells, red blood cells, casts and epithelial cells. Urine was also cultured on Cysteine Lactose electrolyte deficiency (CLED) agar media using the streak plate method by use of a calibrated inoculation loop of size 0.001CFU/L, the plates were then incubated at 37°C and read within 18-24 hours for significant bacteriuria. Significant bacteriuria was defined as a single colony count of $\geq 10^5$ organisms. The organisms were isolated and identification of pathogens was done using standard biochemical and sugar fermentation tests. Antibiotic susceptibility tests were also conducted on them by plating on Muller Hinton agar employing the Kirby Bauer disc diffusion method.

2.4 Statistical Analysis

Data collected was entered to Microsoft Excel and further analyzed using SPSS version 22.0. Variables were reported in mean, standard deviation, percentages and bar graph. Chi

105 square was also used to establish statistical difference and association between variables
106 where *p*-value <0.05 was considered as statistically significant.

107
108 **3. RESULTS AND DISCUSSION**

109
110 **Table 1** depicts demographical data of 200 pregnant women enrolled in the study. Out of
111 this, (30.5%) each of participants were found in both 26-30 and 31-35 year groups with
112 (90.5%) of participants being Christians. A higher percentage, (88.0%) were married.
113 Majority, (44.0%) and (49.0%) of participants had secondary education and in their second
114 trimester respectively. The mean hemoglobin level was 11.45±0.08 whiles greater portions
115 (42.0) and (41.5) of these pregnant women were overweight and obese correspondingly.

116 The overall prevalence of ASB was 23 (11.5%). Among the age ranges, 41-45 age group
117 had the highest prevalence (28.6%) of ASB whiles the least (3.4%) was found among 36-40
118 age group. Prevalence of ASB was also found higher, (12.7%) and (25.0%) among pregnant
119 women who were not married and Christians respectively. However, no prevalence of ASB
120 was found among Muslims. Also, ASB prevalence was highest (18.8%) and (14.3%) among
121 women who had no formal education and in their first trimester duration of pregnancy
122 correspondingly. Pregnant women who were overweight had the highest (14.3%) prevalence
123 of ASB. **(Table 1)**

124 The association between marital status and prevalence of ASB was significant (Pearson chi2
125 = 4.88, p-value = 0.027). Also, the relationship between haemoglobin level and prevalence
126 of ASB was significant (p = 0.018). All the other demographic factors were not significant
127 and had no association with prevalence of ASB. **(Table 1)**

128

129 **Table 1: Prevalence of ASB and demographic characteristics of study population**

Characteristic	Non-Bacteriuria N (%)	Bacteriuria N (%)	Total N (%)	X^2	*P*-value
Age (years)					
15-20	11 (78.6)	3 (21.4)	14 (7.0)	6.513	0.259
21-25	25 (89.3)	3 (10.7)	28 (14.0)		
26-30	52 (85.2)	9 (14.8)	61 (30.5)		
31-35	56 (91.8)	5 (8.2)	61 (30.5)		
36-40	28 (96.6)	1 (3.4)	29 (14.5)		
41-45	5 (71.4)	2 (28.6)	7 (3.5)		
Marital Status				4.884	0.027*
Married	159 (90.3)	17 (9.7)	176 (88.0)		
Single	18 (75.0)	6 (25.0)	24 (12.0)		
Education				2.434	0.487
None	13 (81.2)	3 (18.8)	16 (8.0)		
Basic	55 (87.3)	8 (12.7)	63 (31.5)		
Secondary	81 (92.0)	7 (8.0)	88 (44.0)		
Tertiary	28 (84.8)	5 (15.2)	33 (16.5)		
Trimester				1.015	0.602
1st	6 (85.7)	1 (14.3)	7 (3.5)		
2nd	89 (90.8)	9 (9.2)	98 (49.0)		
3rd	82 (86.3)	13 (13.7)	95 (47.5)		

Religion				2.728	0.099
Christian	158 (87.3)	23 (12.7)	181 (90.5)		
Muslim	19 (100.0)	0 (0.0)	19 (9.5)		
BMI				1.997	0.850
Underweight	1 (100.0)	0 (0.0)	1 (0.5)		
Normal	28 (87.5)	4 (12.5)	32 (16.0)		
Overweight	72 (85.7)	12 (14.3)	84 (42.0)		
Obese	76 (91.6)	7 (8.4)	83 (41.5)		
ASB Status	177 (88.5)	23 (11.5)	200 (100.0)	-	-
Hb g/dl	11.45±0.08	10.76±1.35	10.83±1.32		0.018*

130 *N: Number; * Significant at p< 0.05; ASB: Asymptomatic Bacteriuria*
131
132
133 **Table 2** shows the dip stick examination for urine chemistry which revealed majority of the
134 participants testing negative for both nitrite and leukocyte esterase test. However, 24(12.0%)
135 and 38(19.0%) tested positive for nitrite and leukocytes esterase respectively. In addition,
136 the urine microscopy also showed 11(5.5%) cases of yeast like cells infection.
137

138 **Table 2: Urinary parameters among pregnant women**

Urine Chemistry Parameters	N (%)
Leukocytes	
Positive	38 (19.0)
Negative	162 (81.0)
Nitrite	
Positive	24 (12.0)
Negative	176 (88.0)
Yeast-like cells	11 (5.5)

139 *N: Number*
140
141
142
143 **Figure 1** represents frequency of the bacteria isolates, the predominant isolate was *E coli*
144 (43.6%), followed by *CoNS*, *Citrobacter spp, Enterococcus spp* and *Klebsiella spp* as
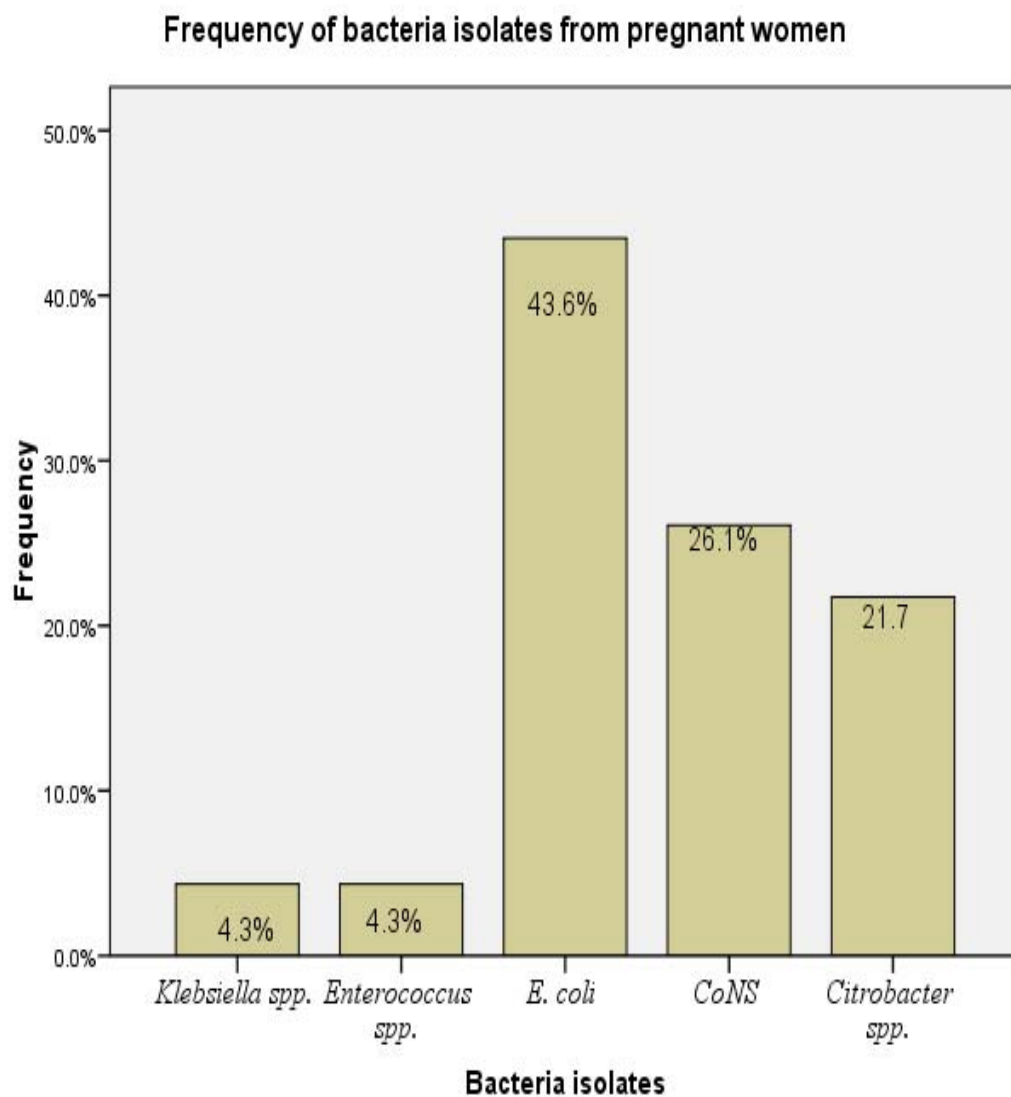145 (26.1%), (21.7%), (4.3%) and (4.3%) respectively.

Frequency of bacteria isolates from pregnant women

146
147   **Figure 1**: Frequency of bacteriuria isolate among pregnant women

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149
150   With respect to gram negative isolates, the antimicrobial susceptibility pattern showed
151   Gentamicin and Norfloxacin to be the most effective antibiotics whereas Ciprofloxacin was
152   found to be the most resistant antibiotic. On the other hand, for overall gram positive
153   isolates, Gentamicin and Norfloxacin showed the most sensitivity rates while the most
154   resistant drugs were Chloramphenicol, Ampicillin and Amoxillin. **(Table 3)**

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Table 3: Antimicrobial susceptibility pattern of bacteria isolates from urine culture of pregnant women

ISOLATES	N		GEN	NOR	AMO	OFLO	TET	CRP	AMP	COT
						ANTIBIOTICS				
Gram Negative										
CoNS	6	S	6(100.0)	6(100.0)	1(16.7)	5(83.3)	1(16.7)	0(0.00)	2(33.3)	5(83.3)
		R	0(0.00)	0(0.00)	5(83.3)	1(16.7)	5(83.3)	6(100.0)	4(66.7)	1(16.7)
Gram Positive										
Citrobacter	5	S	5(100.0)	5(100.0)	0(0.0)	3(60.0)	2(40.0)	0(0.0)	0(0.0)	4(80.0)
		R	0(0.00)	0(0.00)	5(100.0)	2(40.0)	3(60.0)	5(100.0)	5(100.0)	1(20.0)
E.coli	10	S	10(100.0)	10(100.0)	0(0.0)	3(30.0)	3(30.0)	0(0.0)	0(0.0)	8(80.0)
		R	0(0.0)	0(0.0)	10(0.0)	7(70.0)	7(70.0)	10(100.0)	10(100.0)	2(20.0)
Enterococcus	1	S	1(100.0)	1(100.0)	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)	1(100.0)
		R	0(0.0)	0(0.00)	1(100.0)	1(100.0)	1(100.0)	1(100.0)	1(100.0)	0(0.00)
Klebsiella spp.	1	S	1(100.0)	1(100.0)	0(0.0)	1(100.0)	0(0.00)	0(0.00)	0(0.00)	1(100.0)
		R	0(0.0)	0(0.0)	1(100.0)	0(0.00)	1(100.0)	1(100.0)	1(100.0)	0(0.00)
TOTAL	17	S	17(100.0)	17(100.0)	0(0.0)	7(41.2)	5(29.4)	0(0.00)	0(0.00)	14(82.4)
		R	0(0.0)	0(0.0)	17(100.0)	10(58.8)	12(70.6)	17(100.0)	17(100.0)	3(17.6)

160 *N-Number: S-Sensitivity: R-Resistance: CoNS- Coagulase Negative Staphylococcus:*
161 *E. coli- Escherichia coli: GEN-Gentamicin: NOR- Norfloxacin: AMO-Amoxicillin: OFLO-*
162 *Ofloxacin: CIP-Ciprofloxacin: TET-Tetracycline: CRP- Chloramphenicol: AMK-*
163 *Amikacin: AMP-Ampicillin: COT: Cotrimoxazole and CEF-Ceftriaxone*
164
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167
168 Prevalence of ASB revealed from the study among pregnant women was 11.5% which was
169 coherent with a similar study conducted in Dhaka by Jubaida and colleagues whose study
170 found a prevalence of 10.2% (Jubaida *et al.*, 2013). However, other studies revealed
171 contrast results; a recent similar study conducted in Iran revealed a prevalence of 6.5% for
172 significant ASB which is relatively lower compared to the prevalence from this study
173 (Etminan-Bakhsh, Tadi, & Darabi, 2017). This relatively low prevalence might be due to
174 screening and treatment being carried out irrespective of symptoms by the subjects which is
175 not usually practiced in our setting. Again, a study by Labi and colleagues predicted a far
176 lower prevalence of 5.5% per their study (Labi, Yawson, Ganyaglo, & Newman, 2015). Other
177 studies showed relatively higher prevalence rates compared to that from this study (J.
178 Akerele *et al.*, 2001; A. Boye *et al.*, 2012; Imade, Izekor, Eghafona, Enabulele, & Ophori,
179 2010,; Mokube , Atashili, Halle-Ekane , Ikomey, & Ndumbe 2013) who reported 29.5%,
180 86.6%, 56.5%, 23.5%, and 45.3% respectively. Inconsistency in the prevalence rates from

181 these various studies may be due to differences in the socio-demographic characteristics of
182 the study population.
183
184 Out of the overall prevalence, E*scherichia coli* emerged the predominant bacteria isolated
185 with a prevalence of 43.6%. This result is comparable with other studies which also revealed
186 *E. coli* as the most prevalent isolate (Kerure, Surpur, Sagarad, & Hegadi, 2013; Senthinath
187 *et al.*, 2013; Sheiner, Mazor-Drey, & Levy, 2009). On the contrary, the result is dissimilar to a
188 study conducted in Nigeria where *Klebsiella specie*s was the most prevalent organism
189 isolated (Izuchukwu, Oranu, Bassey, & Orazulike, 2017). Another study found S. *aureus* to
190 be the predominant bacterium isolated (Olamijulo, Adewale, & Olaleye, 2016). There was a
191 significant association between marital status and asymptomatic bacteriuria (***P=0.027***), with
192 the unmarried group having a relatively higher ASB compared to the married group, a finding
193 different from a study by Olamijulo *et al.* (2016). The high amount of bacterial isolates (BI)
194 among the unmarried group could be associated with sex activities before and after women
195 conceived.
196
197 The laboratory analysis for Antibiotic Susceptibility Test (AST) showed that all five (5)
198 isolates were most susceptible to Gentamicin and Norfloxacin. However, among the twelve
199 (12) different drugs used for the study, the most resistant drugs were Ciprofloxacin,
200 Chloramphenicol, Ampicillin and Amoxillin; Ciprofloxacin showed high resistance among the
201 gram positive organisms whiles the rest predicted relatively low resistances among gram
202 positive organisms. However, comparatively the highly susceptible antibiotics (Gentamicin,
203 Norfloxacin, Ofloxacin, Cotrimoxazole and Ceftriaxone) were also found to be highly
204 effective from studies by OKALLA, SHU, ETOGA, MENGUE, and ADIOGO (2018) in
205 Cameroon, Alemu, Dagnew, Alem, and Gizachew (2013) in Ethiopia, Onanuga, Omeje, and
206 Eboh (2018) in Bayelsa state Nigeria, A.   Boye *et al.* (2012) and Turpin *et al.* (2007) in
207 Ghana, and Mokube, Atashili, Halle-Ekane, Ikomey, and Ndumbe (2013) in Buea State.
208
209 On the contrary, Sujatha and Nawani (2014) and Alex Boye *et al.* (2012) found Tetracycline,
210 Ampicillin, and Amikacin as susceptible to both gram positive and negative organisms.
211 Ferrieres, Hancock, and Klemm (2007) stated that clear alternatives as a first line drug
212 against UTI before culture and sensitivity were Gentamicin and Norfloxacin but Gentamicin
213 was relatively safer in pregnancy and effective against most urinary tract infections
214 (Kenechukwu , Chinekwu , Davidson , & Golibe 2005; Miglioli , Silini , Carzeri , Grabocka , &
215 Allerberger 1999) but may cause nephrotoxicity and negative fetal conditions when used
216 adversely and close to term during pregnancy (Noel , Tufon, Waindim, Akwo, & Bong, 2013).
217 The high resistance among Penicillin related antibiotics might be associated with high rate of
218 its abuse unlike the aminoglycosides and the fluoroquinolones whose low resistance may be
219 due to their less availability and the wide range of antibiotic therapy.
220
221 The number of leukocyte esterase positive reactions of the urine dip stick was greater than
222 nitrite reactions which is mostly used in most hospitals, clinics and some health centers for
223 bacteria identification during routine urine examination. Detection of presence of bacteria by
224 nitrite reaction using the urine dipstick was highly specific but lacked sensitivity resulting in
225 consequence of having a number of false negatives. A method comparative study by Habiba
226 Ibrahim and Yunusa, 2015 revealed similar results supporting the false negativity of the urine
227 dipstick in detecting bacteria in urine. However, other studies showed contrasting results to
228 that from this study (Okusanya, Aigere, Eigbefoh, Okome, & Gigi, 2014; Shelton, Boggess,
229 Kirvan, Sedor, & Herbert, 2001). Clearly this shows that the dip stick cannot identify non-
230 nitrate producing bacteria as well as urine that stays in the bladder for a short period before
231 it is voided, thereby making it present with shortfalls as a routine test kit.
232

233 The results of this study support the suggestion that urine culture should be the method of
234 choice for screening among pregnant women. Therefore, ASB identification among pregnant
235 women should be treated as per antimicrobial sensitivity pattern of the isolate to prevent
236 overlook of some bacterial growth thereby leading to maternal and perinatal morbidity.
237
238 Another observation was the presence of 23 Bacteria isolates among the Christian
239 participants compared to none among the Muslims. This might be attributed to effective
240 rinsing of the vulva following every episode of urination among Muslims, a practice in the
241 religion. Furthermore, high bacteriuria was found among the 41-50 age group. This general
242 revelation of ASB isolation being more in the older women compared to young females might
243 be due to the action of hormones leading to increased deposition of glycogen within the
244 smooth muscles. This then attracts lactobacillus activity which is glycogenphilic and thus
245 colonizing the vaginal epithelium, making it acidic and hence preventing invasion of the
246 region by other pathogens. Therefore, decreasing glycogen deposition, and reduction in the
247 lactobacillus colonies as part of ageing process enhance bacterial adherence and invasion
248 by pathogens, making them more susceptible to UTI (Eschenbach *et. al.*, 1992)*.* However, a
249 similar study found high bacteria isolates among 21-25 age group which was likely to be an
250 active sex group (A. Boye *et al.*, 2012). The anatomical relationship of the female urethra to
251 the vagina makes it liable to trauma during sexual intercourse and this can increase
252 bacteriuria.(A. Boye *et al.*, 2012).
253
254 Prevalence of ASB was found to be high among pregnant women in their 1st and 3rd
255 trimesters from this study. A previous study carried out by Olusanya and Olutiola (1984)
256 also confirms the high prevalence among the third trimester group whiles another study also
257 found a high ASB isolates among the 2nd trimester group (A. Boye *et al.*, 2012). Finally,
258 hemoglobin was found to be significantly associated with bacteriuria (***P=0.018***). This clinical
259 condition might be due to the production of polysaccharides, endotoxins and particularly
260 hemolysis by most of the bacteria which causes tissue such red blood cells damage.
261
262 **4. CONCLUSION AND RECOMMENDATIONS**
263
264 Overall prevalence of asymptomatic bacteriuria was 11.5% among the referral pregnant
265 women attending KBTH with *E. coli* 43.6% being the predominant isolate followed by CoNS
266 26.7% which were all susceptible to Gentamicin and Norfloxacin. The study showed clearly
267 that urine dip stick method is not a "gold" process for bacteria identification since it cannot
268 isolate most of the gram positive bacteria.
269
270 The study recommends that screening and treatment of asymptomatic bacteriuria in
271 pregnancy should be an integral part of obstetric care and should be included in all antenatal
272 guidelines. Also, all urine samples from pregnant women should be cultured for ASB
273 isolation and hence an appropriate drug selection via AST process. Furthermore, urine
274 culture should serve as the gold standard as against the urine dipstick method and be
275 practiced among all facilities to help reduce incidence of misdiagnosis. Lastly, from this study
276 we recommend and advocate that all Penicillin related antibiotics should not be used for the
277 treatment of ASB.
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280
281 **LIMITATION**
282
283 Some participants might have not been able to adequately follow the mid-stream urine
284 collection.
285

286 **COMPETING INTERESTS**
287
288 The authors hereby declare that there are no competing interests regarding the publication
289 of this article.
290
291
292 **CONSENT (WHERE EVER APPLICABLE)**
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294 Written informed consent was obtained from participants before the study took place and
295 these documents are preserved by the authors.
296
297 **ETHICAL APPROVAL (WHERE EVER APPLICABLE)**
298
299 Ethical clearance was sought from the Institutional Review Board of the University of Cape
300 Coast (IRB/UCC) and administrators of the Hospital before the study was commenced. In
301 addition, all pregnant women recruited into the study gave their informed consent after
302 thorough explanation of the rationale of the study.
303
304 **REFERENCES**

307 Aboderin, A. O., Ako-Nai, A. K., Zailani, S. B., Ajayi, A., & Adedosu, A. N. (2004). A Study of Asymptomatic
308   Bacteriuria in Pregnancy in Ile-Ife, Southwestern Nigeria. . *Afr J Exper. Microbiol, 5*, 252-259.
309 Akerele, J., Abhulimen, P., & Okonofua, F. (2001). Prevalence of asymptomatic bacteriuria among pregnant
310   women in Benin City, Nigeria. *J Obstet Gynaecol, 21*(2), 141-144.
311 Akerele, P., Abhuliren, F., & Okonofua, J. (2001.). Prevalence of asymptomatic bacteriuria among pregnant
312   women in Benin city. Nigeria . *J. Obstruct. Gynaecol, 21*(2), 141-144.
313 Akinloye, O., Ogbolu, D. O., Akinloye, O. M., & Alli, O. A. T. (2006). Asymptomatic bacteriuria of pregnancy in
314   Ibadan, Nigeria: a re-assessment. . *Br J Biomed Sci., 63*.
315 Alemu, A., Dagnew, M., Alem, M., & Gizachew, M. (2013). Uropathogenic bacterial isolates and their
316   antimicrobial susceptibility patterns among HIV/AIDS patients attending Gondar University Specialized
317   Hospital, Gondar, Northwest Ethiopia. *Journal of Microbiology Research and Reviews, 1*(4), 42-51.
318 Alemu, A., Moges, F., Shiferaw, Y., Tafess, K., Kassu, A., Anagaw, B., & Agegn, A. (2013). Prevalence and
319   antimicrobial susceptibility of asymptomatic significant bacteriuria among new antenatal enrollees in
320   Southwest, Nigeria. *International Research Journals of Microbiology, 4*(8), 197-203.
321 Boye, A., Siakwa, P. M., Boampong, J. N., Koffuor, G. A., Ephraim, R. K. D., Amoateng, P., . . . Penu, D.
322   (2012). Asymptomatic urinary tract infections in pregnant women attending antenatal clinic in Cape
323   Coast, Ghana. *E3 J Med Res, 1*(6), 74-83.
324 Boye, A., Siakwa, P. M., Boampong, J. N., Koffuor, G. A., Ephraim, R. K. D., Amoateng, P., . . . Penu, D.
325   (2012). Asymptomatic urinary tract infections in pregnant women attending antenatal clinic in Cape
326   Coast, Ghana. *E3 Journal of Medical Research, 1*(6), 74-83.
327 Eschenbach et. al. (1992). Asymptomatic Bacteriuria among pregnant women. *Clinical Microb. J, 27*, 251-256.
328 Etminan-Bakhsh, M., Tadi, S., & Darabi, R. (2017). Asymptomatic bacteriuria in pregnant women attending
329   Boo-Ali Hospital Tehran Iran: Urine analysis vs. urine culture. *Electronic physician, 9*(11), 5760.
330 Ferrieres, L., Hancock, V., & Klemm, P. (2007). Biofilm exclusion of uropathogenic bacteria by selected
331   asymptomatic bacteriuria Escherichia coli strains. *Microbiology, 153*(6), 1711-1719.
332 Gupta, K., Sahm, D. F., Mayfield, D., & Stamm, W. E. (2001). Antimicrobial resistance among uropathogens
333   that cause community-acquired urinary tract infections in women: a nationwide analysis. *Clin Infect
334   Dis., 33*, 89-94.

Hooton , T. M., Winter , C., Tiu , F., & Stamm , W. E. (1995). Randomized comparative trial and cost analysis of 3-day antimicrobial regimens for treatment of acute cystitis in women. *JAMA, 273*, 41-45.

Imade, P. E., Izekor, P. E., Eghafona, N. O., Enabulele, O. I., & Ophori, E. (2010,). Asymptomatic bacteriuria among pregnant women. *North American Journal of Medical Sciences, 2*, 263.

Izuchukwu, K. E., Oranu, E. O., Bassey, G., & Orazulike, N. C. (2017). Maternofetal outcome of asymptomatic bacteriuria among pregnant women in a Nigerian Teaching Hospital. *Pan African Medical Journal, 27*(1).

Jubaida, N., Kawsar, N. M., Elora, N., Rahimgir, M., Shapla, N. R., & Muid, S. A. (2013). Prevalence of asymptomatic bacteriuria in pregnant women. *Journal of Armed Forces Medical College, Bangladesh, 9*(2), 64-69.

Kacmaz, B., Cakir, O., Aksoy, A., & Biri , A. (2006). Evaluation of rapid urine screening test to detect asymptomaitic bacteriuria in pregnancy. *2006, 59*(4), 261-263.

Kenechukwu , M., Chinekwu , O., Davidson , N., & Golibe , U. (2005). Antibiotic sensitivity patterns in urinary tract infections at the tertiary Hospital. *Medikka(Journal of the University of Nigeria Medical Students).*

Kerure, S. B., Surpur, R., Sagarad, S. S., & Hegadi, S. (2013). Asymptomatic bacteriuria among pregnant women. *Int J Reprod Contracept Obstet Gynecol, 2*(2), 213-216.

Kiningham, R. B. (1993). Asymptomatic bacteuria in pregnancy. *Am Fam Physician, 47*(5), 1232-1238.

Kriplain, A., Bukshee , K., & Rafan, A. (1993). Asymtomatic bacteriuria in pregnant women,India *Obstet Gynaecol India, 43*, 489-491.

Labi, A., Yawson, A., Ganyaglo, G., & Newman, M. (2015). Prevalence and associated risk factors of asymptomatic bacteriuria in ante-natal clients in a large teaching hospital in Ghana. *Ghana medical journal, 49*(3), 154-158.

Lavanya, S. V., & Jogalakshmi, D. (2008). Asymptomatic bacteriuria in antenatal women. *Indian J. Med. Microbiol., 20*(2), 105-106.

Maclean, A. B. (1997). Urinary tract infection in pregnancy,. *Br J Urol ,, 7*(80), 10-30.

Mezue, K., Ofong, C., Nmezi, D., & Ugochukwu-Obi, G. (2006). Antibiotic Sensitivity patterns in urinary tract infections at a Tertiary Hospital. *Journal of the University Of Nigeria Medical students, 12*(2).

Miglioli , P. A., Silini , R., Carzeri , O., Grabocka , E., & Allerberger , F. (1999). Antibacterial activity of gentamicin and ciprofloxacin against gram negative bacteria:
. *Pharmacological Research, 39*(4), 321–323.

Mokube, M. N., Atashili, J., Halle-Ekane, G. E., Ikomey, G. M., & Ndumbe, P. M. (2013). Bacteriuria amongst pregnant women in the Buea Health District, Cameroon: Prevalence, predictors, antibiotic susceptibility patterns and diagnosis. *PloS one, 8*(8), e71086.

Mokube , M. N., Atashili, J., Halle-Ekane , G. E., Ikomey, G. M., & Ndumbe , P. M. (2013). Bacteriuria amongst Pregnant Women in the Buea Health District, Cameroon: Prevalence, Predictors, Antibiotic Susceptibility Patterns and Diagnosis. . *PLoS ONE, 8*(8).

Noel , N. N., Tufon, E. N., Waindim, N. Y., Akwo, T. T. C., & Bong, R. N. (2013). Prevalence and Antimicrobial Sensitivity Pattern Amongst Pregnant Women Attending the Northwest Regional Hospital,Bamenda. *VRI Cell signaling J, 1*(1), 3-6.

OKALLA, C. E., SHU, E. Y., ETOGA, M. E., MENGUE, E. R., & ADIOGO, D. (2018). BACTERIAL AND FUNGAL UROPATHOGENS IN DIABETIC PATIENTS AND THEIR SUSCEPTIBILITY PATTERNS: CASE STUDY OF TWO HOSPITALS IN DOUALA. *Asian Journal of Microbiology and Biotechnology, 3*(3), 79-89.

Okpere, E. E. (2003). *Medical Disorders in Pregnancy* (E. Okpere Ed.): Uniben press.

Okusanya, B., Aigere, E., Eigbefoh, J., Okome, G., & Gigi, C. (2014). Is a chlorhexidine reaction test better than dipsticks to detect asymptomatic bacteriuria in pregnancy? *Journal of Obstetrics and Gynaecology, 34*(1), 21-24.

Olamijulo, J. A., Adewale, C. O., & Olaleye, O. (2016). Asymptomatic bacteriuria among antenatal women in Lagos. *Journal of Obstetrics and Gynaecology, 36*(6), 722-725.

Olusanya , O., & Olutiola , P. O. (1984). Studies on bacteriuria in patients and students in Ile-Ife, Nigeria. . *West Afr J Med., 303*, 177-182.

Onanuga, A., Omeje, M. C., & Eboh, D. D. (2018). Carriage of multi-drug resistant urobacteria by asymptomatic pregnant women in Yenagoa, Bayelsa State, Nigeria. *African journal of infectious diseases, 12*(2), 14-20.

389   Patterson, T. F., & Andriole, V. T. (1997). Bacteriuria in Pregnancy. *American Academy of Family Physician, 1*,
390   807-822.
391   Senthinath, T. J., Rajalaksmi, P. C., Keerthana, R., Vigneshwari, R., Revathi, P., Prabhu, N., & Susethira, A.
392   (2013). Original Research Article Prevalence of asymptomatic bacteriuria among antenatal women in
393   rural tertiary care hospital, Tamilnadu, India. *Int. J. Curr. Microbiol. App. Sci, 2*(1), 80-85.
394   Sharma, J. B. (1990). Prevalence of significant bacteriuria in preterm labour. *Obstet Gynaecol India, 40*, 336-
395   338.
396   Sheiner, E., Mazor-Drey, E., & Levy, A. (2009). Asymptomatic bacteriuria during pregnancy. *The journal of
397   maternal-fetal & neonatal medicine, 22*(5), 423-427.
398   Shelton, S. D., Boggess, K. A., Kirvan, K., Sedor, F., & Herbert, W. N. (2001). Urinary interleukin-8 with
399   asymptomatic bacteriuria in pregnancy. *Obstetrics & Gynecology, 97*(4), 583-586.
400   Sujatha, R., & Nawani, M. (2014). Prevalence of asymptomatic bacteriuria and its antibacterial susceptibility
401   pattern among pregnant women attending the antenatal clinic at Kanpur, India. *Journal of clinical and
402   diagnostic research: JCDR, 8*(4), DC01.
403   Turpin, C., Minkah, B., Danso, K., & Frimpong, E. (2007). Asymptomatic bacteriuria in pregnant women
404   attending antenatal clinic at Komfo Anokye Teaching Hospital, Kumasi, Ghana. *Ghana medical journal,
405   41*, 26.
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