Asian Journal of Medicine and Health
3(3): 1-9, 2017; Article no.AJMAH.31408

SCIENCEDOMAIN *international*
www.sciencedomain.org

Asymptomatic Bacteriuria among Pregnant Women at University Hospital in Uyo, Nigeria: Prevalence, Risk Factors and Characteristics

Nseobong Godwin Akpan[1], Ifeanyi A. Onwuezobe[1] and Ukponobong E. Antia[2*]

[1]Department of Medical Microbiology and Parasitology, University of Uyo Teaching Hospital, Uyo, Nigeria.
[2]Department of Biological Sciences, Akwa Ibom State University, Mkpat Enin, Nigeria.

Authors' contributions

The research idea, design and work plan originated from author IAO. Author NGA carried out the laboratory and field exercises necessary for the successful completion of this work. Finally, author UEA handled all literature searches and the preparation of this manuscript for publication. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AJMAH/2017/31408
Editor(s):
(1) Triveni Krishnan, Division of Virology, National Institute of Cholera and Enteric Diseases, Kolkata, India.
Reviewers:
(1) Akobi Oliver Adeyemi, Federal Medical Centre, Niger State, Nigeria.
(2) Murat Varli, Ankara University School of Medicine, Ankara, Turkey.
(3) Ekaterina Kulchavenya, Novosibirsk Research TB Institute, Novosibirsk Medical University, Russia.
Complete Peer review History: http://www.sciencedomain.org/review-history/18277

Original Research Article

Received 4th January 2017
Accepted 22nd February 2017
Published 21st March 2017

ABSTRACT

Aims: To determine the prevalence of Asymptomatic Bacteriuria among pregnant women attending antenatal clinic at the University of Uyo Teaching hospital health care facility, Akwa Ibom State.
Study Design: A cross-sectional study of registered pregnant women attending antenatal clinic at the University of Uyo Teaching Hospital, Uyo, Nigeria.
Place and Duration of Study: The study was done from October 2012 to April 2013 at University of Uyo Teaching Hospital, Uyo, Nigeria.
Methodology: A total of 230 clean catch midstream urine samples from pregnant women were collected and processed for significant bacteriuria as well as data from structured questionnaire were used in this study. Samples were examined macroscopically and microscopically and isolates were identified biochemically. All results were statistically analysed at $P \leq 0.05$ using SPSS version 20.

**Corresponding author: E-mail: ukponobongantia@gmail.com;*

Results: The prevalence of asymptomatic UTI in this study was 19%. The common isolates involved with asymptomatic bacteriuria in this study were *Escherichia coli* (48%), *Staphylococcus aureus* (11%) and *Klebsiella species* (9%). Prevalence of asymptomatic bacteriuria was highest in women over 30 years of age (33%) and within their first trimester (32%). Pregnant women with primary level of education in the hospital also had the highest prevalence of asymptomatic bacteriuria (43%). However, the prevalence of asymptomatic bacteriuria was observed to occur independently of factors such as parity, occupation, pyuria, glycosuria and proteinuria. The most prevalent isolate, *E. coli,* in this study was sensitive to ceftriaxone (100%) and negative for the production of Extended Spectrum Beta Lactamase (ESBL). *Staphylococcus aureus*, next in order of prevalence was sensitive to gentamicin (100%). All other isolates varied in their sensitivity to the antibiotics they were exposed to.

Conclusion: The presence of asymptomatic bacteriuria in this study occurred independently of factors such as parity, occupation, pyuria, glycosuria and proteinuria but there were observable relationship between maternal ages, gestational age and lower educational level of the women and the prevalence of asymptomatic bacteriuria.

Keywords: Asymptomatic bacteriuria; pregnancy; prevalence; urinary tract infections.

1. INTRODUCTION

Urinary tract infection (UTI) is defined as the presence of pathogenic organisms in any one of the structures that comprise the urinary tract [1]. The urinary system consists of the kidneys, ureters, bladder and the urethra. Urinary tract infections may affect the urethra-urethritis, bladder-cystitis, ureters infection, and the kidneys-pyelonephritis. Other structures that eventually connect to or share close anatomic proximity to the urinary tract (for example, prostate, epididymis in men, and vagina in women) are sometimes included in urinary tract infections because they may either cause or be affected by Urinary tract infections [2].

Urinary tract infection may present either as symptomatic (when associated with symptoms) or asymptomatic (when there is no associated symptoms). Asymptomatic bacteriuria refers to the presence of significant pathogenic bacteria within the urinary system without the symptoms of Urinary tract infection being present. Asymptomatic bacteriuria may progress to uncomplicated cystitis and subsequently acute pyelonephritis [3].

Pregnancy-induced anatomical and physiological changes in the urinary system may predispose one to Urinary tract infection. The weight of the gravid uterus on the urinary system can cause hydroureter. Decrease in Bladder tone may cause fluid retention in the system. Gestational glycosuria and proteinuria and high levels of progesterone can lower the bladder and ureter muscle tone causing vesico-ureteric reflux [4]. Asymptomatic bacteriuria constitutes serious cause of morbidity and poor pregnancy outcomes for both the mother and the foetus [3].

In the developed countries, Urinary tract infection in pregnancy affects about 4-7% of the women [5]. However, in Nigeria, studies have it that as much as 18% to 54% of pregnant women in South-Eastern Nigeria and 86.6% of pregnant women in Benin suffer UTI [6-8]. This research was therefore intended to investigate the prevalence and causative agents of asymptomatic bacteriuria in Uyo, the capital city of Akwa Ibom State, Nigeria.

2. MATERIALS AND METHODS

2.1 Study Population

Urine samples were collected from a total of 230 pregnant women between the ages of 14-43 years. All these persons were outpatients attending antenatal clinics in university of Uyo Teaching Hospital (UUTH) Uyo, Akwa Ibom State. The urine samples were obtained by informed consent of the pregnant women used for this study and the ethical approval to that effect was obtained from the ethical committee of the hospital. The number of number of subjects in the control samples was 100.

2.2 Study Design Inclusion and Exclusion Criteria

The study population was made up of registered pregnant women at all stages of pregnancy, attending antenatal clinics in this hospital. All pregnant women currently receiving antibiotics for Urinary tract infection or any type of infection

in this hospital was excluded from this study. In addition, patients and the control subjects who refuse to participate and/or fully cooperate with the guidelines of the study were also excluded.

2.3 Sample Collection

Clean catch mid-stream urine samples were collected in sterile universal containers as described by Karlowsky et al. [9] and Solberg et al. [10]. They were instructed to use the cotton wool swabs impregnated with 0.9% aqueous solution of sodium choride in distilled water, to clean the urethra, vulva and retrovaginal areas anterior-posteriorly (from above-downward), with labia widely held apart, midstream urine samples were collected [11]. The clinic matrons, senior and junior nursing staff assisted in the proper instruction of all the patients (in Pidgin English and Ibibio languages for the educationally less-privileged ones) and supervision of those needing assistance. The patients were given well-structured questionnaire to fill. Information such as Name, Address, Date of Birth (Age at last Birthday), Number of years married, Number of children, spacing of children, gestational age derived from the last menstrual period (LMP) of the patients and from this information, patients were classified into 3 trimesters – first trimesters 0-13 weeks: second trimesters: 14-27 weeks and third trimesters. 28-40 weeks. Also, the educational background and occupation of both the patients and their spouses were noted.

From this information, patients were grouped into social classes 1-5 according to the method developed by Ogunlesi et al. [12]. The questionnaire was further probed into the presence of clinical signs of Urinary tract infection such as abdominal/renal pain, back/flank pain, fever painful/irritating urination, frequency and dysuria. The urine samples produced by the patients were immediately taken to the laboratory as freshly collected samples.

All urine samples were duly labelled and cultured on arrival (between 1-2 hours of collection). This was done to prevent bacterial growth and proliferation in an otherwise insignificant bacterial population specimen [13].

2.4 Microbiological Examination of the Samples

2.4.1 Macroscopic examination

All samples were macroscopically examined for colour, turbidity and odour.

2.4.2 Urine microscopy

The microscopy and cell count were done using the improved Neubaeur's haemocytometer. The haemocytometer was prepared for use by placing a clean grease free cover glass on the chamber and applying a gentle sliding pressure until a correct symmetrical positioning was achieved as indicated by the appearance of interference pattern (Newton's rings). Broken cover glasses were discarded, then uncentrifuged sample was properly mixed and using a clean Pasteur pipette, the aspirated urine was filled into the counting chamber at about 45°. Care was taken to avoid rapid filling, air bubbles and overflow, but when this happened, the chamber was washed and the exercise repeated. After filling the chamber, it was placed on the microscope stage for a few minutes before counting, this was done to enable the streaming of the fluid to cease and the cells settle on the bottom of the chamber.

A high dry magnification (objective x40) piece was used in counting. Cells touching the left hand and/or the upper lines of a square were counted, while those touching the lower and/or the right lines were considered outside the square. The leucocytes were distinguished from the non-squamous epithelial cells using the larger and the nuclear orientation of the latter. The white blood cells (WBC) were counted in the 4 or 2 large squares. A White Blood Cell count of 10 or more cells per cubic millimetre was considered significant [14].

2.4.3 Urine culture-significant bacteriuria estimation

Well mixed urine specimens were cultured on Cystine Lactose Electrolyte Deficient (CLED) and blood agar for the primary isolation of uropathogen using a standard urine wire-loop (2 mm internal diameter) to deliver 0.05 mL of urine. Inoculated plates were incubated at 37^{o}C for 24 hours. Bacteriuria was considered significant when at least 10^5 colony forming units of a single pathogen per millilitre of urine was counted (10^5 CFU/mL of urine). Observed colonies were sub-cultured until pure and distinct colonies were obtained [2].

2.5 Biochemical Testing

All biochemical tests were performed with pure, 24-hour old cultures. Positive and negative controls were included along with test specimens

for the biochemical tests. The biochemical tests were carefully used to screen all isolates before further typing tests were carried out. The methods were based on standard procedures for the identification of bacterial pathogens [14-15].

2.6 Statistical Analysis of Results

At the end, analysis for the frequencies and simple percentages were calculated for the studied variables. The Chi-square (χ^2) test was used to calculate probabilities and determine statistical significance. A *P* value of less than or equal to 0.05 was considered to be statistically significant ($P \leq 0.05$).

3. RESULTS

Out of 230 urine samples examined in this study, 44 (19%) were observed to have Asmyptomatic Bacteriuria (ASP). Pyuria was observed in 10 (4%) of the samples with *E. coli* and *Staphylococcus aureus* occurring as the most common microbial flora in these samples. Glycosuria and proteinuria showed no relationship with asymptomatic bacteriuria (Table 1). There was no statistical difference between asymptomatic bacteriuria, pyuria, glycosuria in this hospital. *P* was less than 0.05.

Table 1. Relationship between significant bacteriuria and the presence of abnormal conditions in pregnant women studied

Abnormal conditions	No. of positive samples (%)
Aymptomatic bacteriuria	44 (19)
Pyuria	10 (4)
Glycosuria	0
Proteinuria	10 (4)
Proteinuria and Glycosuria	0

Of the 44 positive samples, Gram-negative bacteria occurred more frequently than Gram-positive bacteria, constituting 33 (75%) of the total isolates. These include *E. coli,* 21 (48%), *Klebsiella* species, 4 (9%), *Pseudomonas aeruginosa*, 5 (11%) and *Proteus* species, 3 (7%) as shown in Table 2. The frequency of occurrence of *E. coli* was significantly higher than that of other bacteria isolated.

Table 3 shows the prevalence of Asymptomatic Bacteriuria by occupational group. Asymptomatic Bacteriuria was more prevalent in applicants. This constituted 22 % of the pregnant women with Asymptomatic bacteriuria followed by civil servants (21%), self-employ (18%) and house wife (18%). When statistical evaluation was carried out, asymptomatic bacteriuria showed significance with *P* =.0.001.

Table 2. Isolated bacteria and their frequency as obtained from patients under consideration

Bacteria isolates	No. of positive samples (%)
E. coli	21 (48)
Staphylococcus aureus	5 (11)
Staphylococcus saprophyticus	6 (14)
Klebsiella species	4 (9)
Pseudomonas aeruginosa	5 (11)
Proteus species	3 (7)
Total	44 (19)

Table 3. Relationship between asymptomatic bacteriuria and the occupation of the patients studied

Occupation	Number examined	No. positive (%)	*P* value
House wife	49	9 (18)	
Self employed	106	19 (18)	
Civil servants	57	12 (21)	
Applicants	18	4 (22)	0.001
Total	230	44 (19)	

Table 4 shows the prevalence of asymptomatic bacteriuria by trimester. This revealed that women in their 1st trimester of pregnancy had the highest occurrence of Urinary Tract Infection, 18 (32%), with *P* value greater than 0.05, while the least occurrence was (16%) observed in the 2nd trimester, *P* = 0.01.

Table 4. Occurance of asymptomatic bacteriuria and its relationship with different period of pregnancy (Trimester) in the patients studied

Trimester	No. tested	No. positive (%)	*P* value
1st	56	18 (32)	
2nd	116	19 (16)	0.01
3rd	58	7 (12)	
Total	230	44 (19)	

Distribution of Urinary Tract Infection in relation to parity (No. of pregnancy) is showed in Table 5. Seventeen (30%) of 56 women who had one

child had the highest occurrence of Urinary Tract Infection, while parity number of 5 and above although few in number was 0% with no bacteria growth. There was statistical significant relationship with asymptomatic bacteriuria and parity (*P*= 0.002).

Table 5. Prevalence of asymptomatic bacteriuria by parity in the pregnant women

Parity	No. examined	No. positive(%)	*P* value
0	105	17(16)	
1	56	17(30)	0.002
2	46	6(13)	
3	14	2(14)	
4	7	2(29)	
5 and above	2	0	
Total	230	44	

Table 6 shows the prevalence of asymptomatic bacteriuria in relation to Educational background of the pregnant women. Pregnant women with primary level of education had the highest occurrence of asymptomatic bacteriuria with 7(43%) while the lowest occur in tertiary level of education with 17(14%). There was no statistical relationship between Asymptomatic bacteriuria and patients with primary level of education with *P* =0.112.

The prevalence of bacteriuria in relation to ages of the pregnant women is showed in Table 7. Significant bacteriuria appears to be age-dependent with the lowest incidence (0%) observed at age 14 to 19 years and the highest (33%) at 38 -43 years. These relationship are statistically significant (*p*=0.004).

Table 6. Occurrence of asymptomatic bacteriuria in relationship to the educational background of patients under consideration

Educational background	No. examined	No. positive	*P value*
No formal education	2	0	
Primary	7	3(43)	0.112
Secondary	97	24(25)	
Tertiary	124	17(14)	
Total	230	44(19)	

Table 7. Relationship between asymptomatic bacteriuria and age of the pregnant women

Age group	No. examined	No. positive (%)	*P* value
14-19	6	0 (0)	
20-25	59	12 (20)	
26-31	113	22 (19)	
32-37	49	9 (18)	
38-43	3	1 (33)	**0.004**
Total	230	44 (19)	

Table 8 shows the prevalent organisms in the study varied in their sensitivity to the antibiotics tested. *E. coli* isolates were sensitive to all antibiotics at above 50% except Augmentin. *Pseudomonas aeroginosa* isolates were most sensitive to imipenem and ciprofloxacin. The *Proteus mirabilis* and *Klebsiella pneumonia* isolates were responsive to most of the antibiotics tested except Augmentin. *Staphylococcal species* were least reactive to cefoxitin but averagely sensitive to ciprofloxacin, Nitrofurantoin, azithromycin and gentamicin.

Table 8. Antibiotics sensitivity pattern of the isolates

Antibiotics	*Escherisha coli* N=21	*Pseudomonas aeroginosa* N= 5	*Proteus mirabilis* N=3	*Klebsiella pneumonia* N=4	*Staphylococcus* spp. N=11
Ceftazidine	18 (86)	4 (80)		4 (100)	
Augmentin	3 (1)		0	2 (50)	
Ceftriaxone	21 (100)	3(60)		4 (100)	
Ciprofloxacin	14 (67)	5 (100)	3 (100)		8 (73)
Nitrofurantoin	19 (90)			4(100)	10(91)
Cefotaxime	14(67)			3(75)	
Gentamicin		3 (60)	3 (100)	4 (100)	11 (100)
Imipenem		5 (100)			
Carbenicillin		2(40)			
Cefepime			2 (67)		
Cefuroxime			3 (100)		
Cotrimoxazole			3 (100)		4 (36)
Azithromycin					9 (82)
Cefoxitin					4 (36)

4. DISCUSSION

Asymptomatic bacteriuria and Urinary Tract Infection constitute serious causes of morbidity and poor pregnancy outcomes. The fact that asymptomatic bacteriuria presents itself without noticeable symptoms of infection is a major public health concern. Thus, there is need to constantly monitor the prevalence of this infection especially in pregnant women in order to prevent complications associated with its occurrence.

The prevalence of asymptomatic bacteriuria in pregnant women under consideration was 19%. This result is comparable to the observations made by other researchers such as Oli et al. (2010) [8] who observed 18% prevalence rate in Nnamdi Azikiwe University Teaching Hospital Nnewi Anambra State. However, this prevalence rate is lower than those of Akerele et al. [6]; Obiogbolu et al. [7]; Kehinde et al. [16], who recorded 28.8%, 54% and 86.6% respectively from their individual study sites.

These rates are very high and reasons may be attributed not only to the anatomical and physiological predisposition of pregnant women to UTI but also due to the rather poor attitude towards antenatal clinics attendance. The situation is even made worse by the exclusion of screening for asymptomatic bacteriuria from the routine antenatal investigation in most of the hospitals in Akwa Ibom State. While pregnant women are willing and in most cases look forward to attending antenatal clinics where such diseases as asymptomatic bacteriuria are detected and managed early to prevent complications in the developed countries, in Nigeria the state of the medical facilities, the level of public health information dissemination, high patient/doctor ratio and long waiting time in clinics among others have resulted in poor patient attitude and health outcome of pregnant women as also observed in Akwa Ibom state [17].

The prevalence of asymptomatic bacteriuria in relation to the ages of the pregnant women in this study showed that women in the age range 38-43 years (33%) were significantly more predisposed to Urinary Tract Infection than other age group. This implies that pregnant women from 30 years of age and above are more predisposed to UTI than younger women in this community. This finding agrees with the study conducted in Ibadan by Akinloye et al. (2006) (39.1%) [18]. This observation is however different from what was observed in a study done by Imade et al. [19] in Benin City. He observed the highest prevalence of Urinary Tract Infection in pregnancy was within the age group 26-30 years (53.1%). The increased prevalence within this age groups maybe due to the fact that many women within this age groups are likely multiparous. Multiparity is a risk factor for asymptomatic bacteriuria in pregnancy Akinloye et al. [18].

Our study shows that asymptomatic bacteriuria had the highest occurrence in parity number one (1) in the hospital. However, the relationship between parity number and the prevalence of asymptomatic bacteriuria was not clearly established. Other studies have observed relationship between parity and asymptomatic bacteriuria [20].

At the University of Uyo Teaching Hospital, asymptomatic bacteriuria was highest in women at the first trimester. This reveals a risk for pregnant women at this gestational period. The reason for this may be attributed to the frequency of micturation by the pregnant women during this period. Increase in the lipid peroxidation level during pregnancy may also cause an increase in Urinary Tract Infection at the first trimester. This result agree with that of Imade et al. [20] who reported (45%) but disagrees with the work of Perera et al. [21] who reported the highest rate at the third trimester. Vazquez and Villar [22] reported a 10-30% prevalence for women with bacteriuria in the first trimester developed upper Urinary Tract Infection in the second and third trimesters.

An assessment of the relationship between proteinuria, pyuria and bacteriuria revealed no statistical relationship. However, proteinuria and pyuria were noted to be significantly higher in women without significant bacteriuria. This may mean that proteinuria and pyuria should not to be used as predictive criteria of significant bacteriuria. Pyuria for instance, may be present in women with Chlamydia, urogenital tuberculosis and renal myco-bacterial infections (Hwang et al.) [23] and then significant bacteriuria may be present without pyuria due to contamination or inappropriate collection of the sample, production of leucocyte destroying enzyme by bacteria (leukocidin by Staphylococcus aureus), neutropaenia (people with poor cell-mediated immune response) while gestational proteinuria and glycosuria may be due to physiological challenges of the

pregnancies not related to the presence of bacterial infections. Therefore, the use of microscopic urinalysis is not effective method of dictating asymptomatic bacteriuria [24].

The most significant organisms isolated in this study were *Escherichia coli* (48%) and Staphylococcus species (28%). This could be due to the fact that urinary stasis is common in pregnancy and since most strains of Escherichia coli prefer that environment, they cause Urinary Tract Infection. Another reason could be as a result of poor genital hygienic practices by pregnant women who may find it difficult to clean their anus properly after defecating or cleaning their genital after passing urine. Additionally, Pseudomonas species, Proteus and Klebsiella revealed by the study have been reported in studies done in Asia as less common organisms causing Urinary Tract Infection [25,19].

The organism specific antimicrobial susceptibility testing showed Staphylococcus species were most sensitive to Ciprofloxacin (73%), Nitrofurantoin (91%), Azithromycin (82%) and Gentamicin (100%) which is similar to the work of Imade et al. [19]. This means that these antibiotics are still effective in the management of Urinary Tract Infection in this locality. However, an important observation in this work is the increasing pattern of resistance of *Staphylococcus aureus* to Cefoxitin. *Esherishia coli* was sensitive to Ceftriaxone, Ciprofloxacin, Cefotaxime, Nitrofurantoin and Ceftazidine. Even though the *Escherishia coli* isolates were poorly sensitive to Augmentin, test for the production of Extended Spectrum Beta Lactamase was 100% negative. This indicates that the Cephalosporin drugs can still be effective in the treatment of asymptomatic bacteriuria in this environment. The Antibiotic, Imipenem, showed 100% anti-pseudomonas activity. This is in contrast to emerging trend of Imipenem resistance reports elsewhere by Lautenbsch et al. [26]. This may be due to the reserved prescription and sales of the drug in Nigeria as the drug is not only expensive but also not readily available in Pharmacy shops.

5. CONCLUSION

In conclusion, the prevalence of asymptomatic bacteriuria in pregnant women at the antenatal clinic was 19%. The presence of asymptomatic bacteriuria in this study occurred independently of factors such as parity, occupation, pyuria, glycosuria and proteinuria but there were observable relationship between maternal ages, gestational age and lower educational level of the women and the prevalence of asymptomatic bacteriuria.

6. LIMITATION OF THE STUDY

It was difficult getting the pregnant women to cooperate in the areas of convincing them to participate in the study and proper sample collection. Greater efforts and time had to be put into educating participants on these.

7. RECOMMENDATION

- Since Urinary Tract Infection presenting as asymptomatic bacteriuria is a potential source of hazard to pregnancy and this condition is common in pregnant women in Akwa Ibom State. Routine screening for asymptomatic bacteriuria should be done in all the pregnant women during antenatal visit at least once in the first and second trimester.
- There should be increase in public health information dissemination, preventive measures for Urinary Tract Infection in pregnancy in the state.
- More intensive public health mobilization should be made to encourage utilization of orthodox antenatal health care services, improve facilities of antenatal health care and subsidized cost of care.
- More state wide multicenter researches should be done on the prevalence of asymptomatic bacteriuria in pregnancy to understand the full weight of this problem.

ETHICAL APPROVAL

All authors hereby declare that all experiments have been examined and approved by the appropriate ethical committee and have therefore been performed in accordance with the ethical standards laid down by the Ethical Committee of the University of Uyo Teaching Hospital.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Centers for Disease Control and Prevention (CDC). Catheter-associated urinary Tract infections (CAUTI). National Center for Emerging and Zoonotic Infectious Disease (NCEZID) Division of Healthcare Quality Promotion (DHQP).

2011. Date Accessed: 21st August, 2012. Available:http://www.cdc.gov/HAI/ca_uti/uti.html

2. Bryan, C. Infectious disease, Urinary tract infections from Infectious Disease Section of Microbiology and Immunology On-line. University of South Carolina. 2011. Date accessed: 21st August, 2012.
Available:http://pathmicro.med.sc.edu/infectious%20disease/Urinary%20Tract%20Infections.htm
3. Smail F, Vazquez JC. Antibiotics for asymptomatic bacteriuria in pregnancy. Cochrane Database of Systematic Reviews. 2007;2:CD000490.
4. Chaliha C, Stanton SL. Urological problems in pregnancy. British Journal of Urology International. 2002;89:469-76.
5. McCormick T, Ashe RG, Kearney PM. Urinary tract infection in pregnancy. The Obstetrician and Gynaecologist. 2008;10: 156-62.
6. Akerele J, Abhulimen P, Okonofua F. Prevalence of asymptomatic bacteriuria among pregnant women in Benin city, Nigeria. Journal of Obstetrics and Gynaecology. 2001;21:141–54.
7. Obiogbolu CH, Okonko IO, Anyamere CO, Adedeji AO, Akanbi, A Ogun, AAO. Incidence of urinary tract infection amongst pregnant women within Akwa Metropolis, Southeastern Nigeria. Scientific Research and Essay. 2009;4:820-4.
8. Oli AN, Okafor CI, Ibezim EC, Akujiobi CN, Onwunzo MC. The prevalence and bacteriology of asymptomatic bacteriuria among antenatal patients in Nnamdi Azikiwe University Teaching Hospital Nnewi; South Eastern Nigeria. Nigerian Journal of Clinical Practice. 2010;13:409-12.
9. Karlowsky JA, Hoban DJ, Decorby MR, Laing NM, Zhanel GG. Fluoroquinolone-resistant urinary isolates of Escherichia coli from outpatients are frequently multi-drug: results from the North American urinary tract Infection collaborative alliance-quinolone resistance study. Antimicrobial Agents and Chemotherapy. 2012;50:2251-4.
10. Solberg OO, Ajiboye R, Riley LW. Origin of class 1 a integron and gene cassettes in a population-based sample of uropathogenic *Escherichia coli*. Journal of Clinical Microbiology. 2006;44:1347-51.
11. Agency for Clinical Innovation (ACI) Urology Network. Collection of Urine. 2012. Date accessed: 2012.
Available:http://www.aci.health.nsw.gov.au/ data/assets/pdf file/0005/165920/Collection- of-Urine-Midstream-Toolikit.pdf
12. Ogunlesi TA, Dedeke IOF, Kuponiyi OT. Socioeconomic classification of children attending specialist paediatric centres in Ogun State, Nigeria. Nigerian Medical Practitioner. 2008;54:21-25.
13. Cheesbrough M. District laboratory practice in tropical countries, Part 2, Cambridge University Press. 2000;69–70.
14. Graham JC, Galloway A. The laboratory diagnosis of urinary tract infection. Clinical Microbiology laboratory, Royal Victoria Infirmary, Queen Victoria Road, Newcastle Upon Tyne, UK. 2001;54:911-9.
15. World Health Organization. Manual for the laboratory identification and antibiotic susceptibility testing of bacterial pathogens of public health importance in the developing world Geneva; 2003.
16. Kehinde AO, Adedapo KS, Aimaikhu CO, Odukogbe AA, Olayemi O, Salako B. Significant bacteriuria among asymptomatic antenatal clinic attendees in Ibadan, Nigeria. Tropical Med and Health. 2011;39:73-6.
17. Dairo MD, Owoyokun KE. Factors affecting the utilization of antenatal care services in Ibadan, Nigeria. Department of Epidemiology and Medical Statistics, College of Medicine, UCH, Ibadan. 2010;12:3-13.
18. Akinloye O, Ogbolu DO, Akinloye OM, Terry Alli OA. Asymptomatic bacteriuria of pregnancy in Ibadan, Nigeria: A re-assessment. British Journal of Biomedical Science. 2006;63:109-12.
19. Imade PE, Izekor PE, Eghafona NO, Ophori E. Asymptomatic bacteriuria among pregnant women North American Journal Medical Science. 2010;2:263–6.
20. Ilusanya OAF, Adesetan TO, Egberongbe HO, Otubushin AT. Asymptomatic Bacteriuria in ante-natal patients attending state hopital, Ado-Ekiti, Ekiti State, Nigeria. Current Research Journal of Biological Sciences. 2012;4:261-4.
21. Perera J, Randeniya C, Perera P, Gamhewage N, Jayalatharchchi R. Asymptomatic bacteriuria in pregnancy: Prevalence, risk factors and causative organisms Sri Lankan Journal of Infectious Diseases. 2012;1:42-6.

22. Vazquez JC, Villar J. Treatments for symptomatic urinary tract infections during Pregnancy. Cochrane Database of systematic Reviews Issue; 2003.
23. Hwang JH, Park HC, Jeong JC, Baek S, Han MY, Bang K. Chronic asymptomatic pyuria precedes overt urinary tract infection and deterioration of renal function in autosomal dominant polycystic kidney disease. BMC Nephrology. 2013;14:1.
24. Rahimkhani M, Khavari-Daneshvar H, Sharifian R. Asymptomatic bacteriuria and pyuria in pregnancy. Acta Medica Iranica. 2008;46:409-12.
25. Girishbabu RL, Srikrishna R, Ramesh ST. Asymptomatic bacteriuria in pregnancy. International Journal of Biological and Medical Research. 2002;740-742.
26. Lautenbsch E, Synnestvedt M, Weiner MG, Bilker WB, Vo L, Schein J, Kim M. Imipenem resistance in *Pseudomonas aeruginosa*: Emergence, epidemiology and impact on clinical and economic outcomes. Infection Control and Hospital Epidemiology. 2010;31:47-53.

Peer-review history:
The peer review history for this paper can be accessed here:
http://sciencedomain.org/review-history/18277