

Correlation of Urinary Tract Infection Pathogens, Antibiogram and Age Group in Pregnant Women

Research Article

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Abstract

Objective: The aim of the study is to detect urinary tract infections (UTI) pathogens, prevalence and antibiotic sensitivity among pregnant women aged 20-45 year in Amman -Jordan.

Method: Total of one hundred and twenty three pregnant women age between 18-42 years suspected of UTI were referred to the laboratories from private antenatal clinics. Voided mid-stream urine samples were collected in wide mouth sterile containers. Samples were cultured and examined microscopically. The isolate were identified based on colonial morphology, microscopic characteristics, and biochemical tests. Antibiotic sensitivity test was then followed.

Results: Out of one hundred and twenty three samples tested only fifty three urine samples showed positive growth with an incidence rate of 43.1%. Out of the positive culture 49 (92.4%) revealed single isolate while 4(7.6%) showed mixed culture. *Escherichia coli* 19(35.8%) was the most predominant organism followed by *Staphylococcus aureus* 11(20.8%), Coliforms 9(17.0%), *Klebsiella pneumoniae* 7(13.2%), *Pseudomonas aeruginosa* 1(1.9%), *Streptococcus faecalis* 1(1.9%), *Proteus mirabilis* 1(1.9%) and mixed culture of *Staphylococcus epidermis* and *Candida albicans* 4(7.5%). Microscopic examination of the positive samples (53) revealed Pus cells in 32 samples (26.0%), red blood cells (rbc) in 12 samples (9.7%), yeast cells in 2 samples (1.6%) and *Trichomonas vaginalis* in 1 samples (0.8%). Age groups 38-42 show the highest incident rate of infection 66.7%. Meropenem and ipenim showed the highest activity (100%) rate.

Conclusion: The high incidence rate 19(35.8%) for *Escherichia coli* and low efficacy rate of antibiotic in pregnant women reported in this study should be of great concern, as not only a threat to health of pregnant women and infants, but they also create an economic and social problems due to the stigma associated with these infections.

Keywords: Bacteriuria; Pregnant women; Urine; Age group

Introduction

Urinary Tract Infections (UTIs) is an infection caused by the presence and growth of microorganism anywhere in the urinary tract and is perhaps the single commonest bacterial infection of mankind [1,2]. Many studies reported the significance of UTI during pregnancy although pregnancy does not cause UTI [3-6], however, the complexity of urinary tract system and changes during pregnancy account for susceptibility to infection [3-5,7,8] Urinary tract infections have been reported in all age groups and can occur in both sexes [2,9] and pregnant women are not an exception [5,6]. UTI is a serious health problem worldwide affecting millions of people each year and the leading cause of Gram-negative bacteria [9,10]. Over eight million cases of UTI annually were reported and more than one million were hospitalized, for an overall annual cost more than \$1 billion [10-12], classifying hospital and antenatal clinic in the lead as source of UTI pathogens [2,13] and responsible for 35% of the cases where bacteraemia was the most common cause in hospitalized patients [14-16] Diagnosis of UTI causing organism is the major work load in medical laboratories where *Escherichia coli* reveal the highest predominate rate although, other reports showed that the causative organism of UTI is changing over the year and other microorganism were responsible for infection [13,14]. Many reports showed that UTI is

common in patients with different symptoms [14]. However, our concern in this study is to focus on pregnant women at different age group were they believed to have highest infection rate [2,14]. Due to the fact that untreated UTI in pregnancy can increase the risks of morbidity, and mortality to pregnant women and infant [17], keeping in mind that estimated 40 percent of women reported to have UTI some time in their lives [15], and by nature women are more susceptible to UTI because accessibility of organism to invade urethra and bladder easier than men [18]. This is partially due to the short and wider female urethra and its proximity to anus. Bacteria from the rectum can easily travel up the urethra and cause infections [2,19,20]. Other factors reported to increase rate of infection are pregnancy and sexual intercourse [19], due to vaginal trauma which enhance access of bacteria to urethral into bladder [2,17,19]. Other factor found to increase rate of infection is using diaphragms during intercourse forming residual urine and hence increase rate of UTI in pregnant women [20,21]. Therefore UTI in pregnant women is of great concern practically in developed countries [22,23], where rational prescribing of drugs by member of health practitioner is difficult to control [24,25]. This study therefore focuses on prevalence and incidence of UTI among pregnant women with deferent age in term of prevalence of organisms and antibiotic sensitivity rate.

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Materials and Methods

Urine samples were collected from a total of 123 pregnant women between the ages of 18 to 42 year were referred to our laboratories as outpatients attending antenatal clinics for routine examination. Suspecting patients with UTI were referred for further investigations. Clean-catch MSU samples were collected in wide open mouth sterile container as described by [26,27]. Patients were instructed to wash and clean urethro-genital organs and to pass the first void of urine then to collect midstream sample into sterile container. The study groups were also stratified by age distribution chart. Samples were labeled and analyzed within 30 minutes of collections.

Urine samples were examined microscopically according to [17]. Those showed 10 white blood cells/ mm³ were regarded as pyuric [28]. Urine culture was then performed. Identification and characterization of isolated bacteria include Gram stain followed by microscopic examination, motility test and biochemical tests as described by [29-32].

For drug susceptibility test Mueller Hinton agar (MHA) was used and commercial antibiotic multidisc were used as described by [4]. Antibiotics discs, Amoxicillin (AMX) 25µg, Augmentin® (AUG) 10µg, Cotrimoxazole (COT), Ciprofloxacin (CIP) 10ug, Gentamycin (GEN)10ug, Imipenim (IPM)10ug, Levofloxacin (LEV) 30ug, Meropenem (MEM) 10ug, Nalidixic acid (NA 30ug), Ofloxacin (OFL) 5µg, were used. Zone of inhibition was measured to determine the level of susceptibility of isolates to the antibiotics. Data obtained in this study were analyzed using SPSS version16.0.

Results

Microscopic observation of one hundred and twenty three MSU samples collected and examined in this study only 32(26.0%) samples were revealed to have white blood cells (pus cells), 12(9.7%) red blood cells (rbc), yeast cells 2(1.6%) and *Trichomonas vaginalis* 1(0.8%) (Table1). Out of 123 samples examined only 53(43.1%) were showed significant bacteriuria, while 70(56.9%) had no significant bacterial growth (Table 2). Culture plates with bacteria counts greater or equal than 1x10⁵ cfu/consider as UTI. Bacterial isolation and identification followed by antibiotic sensitivity test was then performed. Correlation between incidence of UTI and age groups is shown in Table 2, where age groups 38-42 year and 33-37 year shows the highest incident rate of infection 66.7% and 54.5% respectively, followed by age group 28-32 year (42.2%). Meanwhile, age group 18-22 year had the lowest percentage infection rate (33.3%) as shown in Table 2. There is significant statistical variation (P<0.005) between UTI and age group. This is in agreement with other studies [3,8].

The prevalence of gram negative and gram positive obtained in this study are 37(69.8%) and 14(26.4%) respectively, *E. coli* showed the highest prevalence rate followed by *S. Aureus* 11(30.8%) and *K. pneumoniae* 7(13.2%). A mixed culture of *C. albicans* and *S. epidermis* revealed 4(7.6%). Other organism isolated showed different prevalence rate Table 3. It is noticeable that *E. coli* and *S. aureus* were the most common isolates in all age groups

however; *P. aeruginosa* was isolated from age group 38-42 years exclusively.

Results of antibiotic sensitivity test revealed 100.0% activity for meropenem, imipenem and levofloxacin. They are the most active antibiotics. The rate of multidrug resistance is (>50%) (Table 4). These results are worrisome and essential care should be taken in pregnancy unit and efficient drug prescribing policy should be explored.

Table 1: Microscopic examination of urine samples.

Isolates	No. of Positive Samples (%)
Pus cells	32(26.0)
Red blood cells	12 (9.7)
Yeast cells	2 (1.6)
<i>Trichomonas vaginalis</i>	1 (0.8)
Total	47(38.2)

Table 2: Distribution of UTI in different age groups.

Age Group (years)	No. Tested (%)	No. Positive (%)	No. Negative (%)
18-22	24(19.5)	8(33.3)	16(66.7)
23-27	34(27.6)	14(41.4)	20(58.8)
28-32	45(36.7)	19(42.2)	26(57.8)
33-37	11(8.9)	6(54.5)	5(45.4)
38-42	9 (7.3)	6(66.7)	3(33.3)
Total	123(100)	53(43.1)	70(56.9)

Table 3: Frequency of isolation of organisms in pregnant women.

Isolates	No. of Positive sample (%)
<i>E. coli</i>	19(35.8)
<i>S. aureus</i>	11 (20.8)
Coliforms	9 (17.0)
<i>K. pneumonia</i>	7 (13.2)
<i>S. faecalis</i>	1(1.9)
<i>P. mirabilis</i>	1 (1.9)
<i>P. aeruginosa</i>	1(1.9)
Mixed culture of <i>C. albicans</i> & <i>S. epidermis</i>	4(7.5)
Total	53 (100.0)

Table 4: Susceptibility of urine isolates to antibiotic from pregnant women.

Bacteria	No.% Susceptibility	AMX 26ug	AUG 30ug	COT 25ug	CIP 10ug	GEN 10ug	IPM 30ug	MEM 10ug	NA 30ug	OFL 5ug	LEV 10ug
<i>E. coli</i>	19	1 5.3	9 47.3	8 42.2	19 100	6 31.6	19 100	19 100	12 73.6	12 63.2	19 100
<i>S. aureus</i>	11	5 45.5	5 45.5	9 81.8	10 91	3 27.2	11 100	11 100	10 90.9	10 90	11 100
<i>K. pneumoniae</i>	7	1 14.3	3 42.9	6 75	6 85.7	3 42.9	7 100	7 100	6 85.7	6 85.7	7 100
<i>S. faecalis</i>	1	0 0	0 0	1 100	1 100	0 0	1 100	1 100	0 0	0 0.0	1 100
Coliforms	9	2 22.2	7 77.7	4 44.4	8 88.9	7 77.7	9 100	9 100	9 100	9 100	9 100
<i>P. mirabilis</i>	1	0 0	0 0	0 0	1 100	0 0	1 100	1 100	1 100	1 100	1 100
<i>P. aeruginosa</i>	1	0 0	0 0	1 100	1 100	0 0	1 100	1 100	0 0	0 0	1 100
Total	49	9 18.4	24 48.9	29 59.2	46 93.9	19 38.8	49 100	49 100	38 77.6	38 77.6	49 100

Discussion

The incidence of UTI in this study is 43.1%. This is similar to the figures reported in other studies indicated high prevalence rate of UTI 48.0%, 45.3% [33-35], and 58.0% reported by [36]. Also, in agreement with other studies where female showed higher UTI prevalence than male [37-40]. However, the incident rate in this study is higher than the incidence rates reported in other studies [3,8,12,41-45], such a difference could be due to geographic location and different in environmental conditions [3]. Other factors associated with increasing incidence rate in developing countries such as lack of proper hygiene, different environmental status, population susceptibility, low socio-economic status, sexual intercourse and pregnancy [3,41].

Results of the microscopic observation revealed 32 samples have pus cells, 12 samples had red blood cells, 2 samples had yeast cells and 1 had *Trichomonas vaginalis*. There is no statistical significant variation ($P > 0.05$) between these parameters and UTI however this results is in agreement with other study [20].

The pattern and frequency of isolates in this study are similar to what have been previously reported, where *E. coli* was the most dominant organism [6,41-43]. Other organisms were isolated in low rate which is in agreement with other studies [44]. However, their occurrence and resistant pattern to antibiotic should be considered.

The most implicating organisms causing UTI among these pregnant women in this study was *E. coli* (35.8%), followed by *S. aureus* (20.8%), Coliform (17.0%), *K. aerogenes* (13.2%). These finding is similar to other reports which suggest that Gram-negative bacteria, particularly *E. coli* is the most common pathogen isolated in patients with UTI [2,5,44-47]. The pattern of infection by *E. coli*, *S. aureus* and *K. pneumoniae* obtained in this study is in agreement with other study reported by [17], showing similar in-

fection rate and pattern where *E. coli* (51.2%), *S. aureus* (27.3%), and *K. pneumoniae* (12.8%) respectively. However, the 13.2% incidence rate of *K. pneumoniae* reported in this study is consistent with previous study [7], also this bring *K. pneumoniae* as predominant organism in UTI which lay out different status for this organism which disagree with other studies reported by [5,48-50]. Adding to that prevalence of *S. aureus* in UTI in this study is in agreement with other reports [8], but disagrees with earlier study by [51]. This shows that other organisms are revealing prominence in pregnant women UTI.

In this study, a total of 49 cases out of 53 show prevalence rate of 43% of single isolate however only 4(7.5%) showed mixed culture, this results agree with other studies [8], where single isolate was dominant. [10,13]. Age group 38-42 year exhibited the highest prevalence of UTI although. age group 28-32 year showed higher percentage of isolates, this indicate that UTI increase with age [5,10]. Mean while *P. aeruginosa* is one of the least common organism isolated in this study among other *S. faecalis* and *P. mirabilis* which still impressive and should be considered for future treatment. There are other factors assisting high UTI incident rate in pregnant women such as age with acute symptoms [10,13]. However, in asymptomatic UTI changing in vaginal microflora reported to have major effect in women and this is one of the reasons why women have higher incident rate of UTI than men [52]. *E. coli*, *S. aureus*, *K. pneumoniae* and *S. faecalis* also showed a resistance pattern >50% for most of drug used as first line of treatment. This is consistent with other study [9]. Ciprofloxacin and nalidixic acid revealed 85.7-100.0% and 73.6-100.0% activity range respectively. Other antibiotics showed different activity range 63.0-100.0%, 31.6-77.7% and 42.9-77.7% for ofloxacin, gentamicin and augmentin respectively Table 4. The low activity ranges are consistent with other studies [6,7]. The high activity rate of antibiotic reported in this study disagree with other studies [5,53], that might be due to low number of isolate in the study.

Amoxicillin showed very low efficacy (<30%) in this which is in agreement with other study [5], that showed uncontrolled use of amoxicillin over the years for different infections treatment have led to bacterial drug resistance [5,54,55], adding to that rational use of these antibiotics as first line of treatment particularly in developing countries [56,57], had led to MDR development organisms [5]. This is reinforcing the need for laying out control policy for prescribing antibiotics [1-3]. Although organisms such as *S. aureus* and *P. aeruginosa* and have been documented to show MDR [3-6] particularly in Hospital. The high Multidrug resistant pattern for *S. aureus* followed by *P. aeruginosa* and *E. coli* for certain drugs showed is not surprising because these organisms documented to have high resistance rate particularly *S. aureus* [3,5,6], which is commonly found in hospital environment, antenatal clinics and community [4,37]. One of the reasons for acquisition of drug resistant phenomena among organisms is long exposure of these organisms to antibiotics leading to serious problem in health profession treatment strategy [1,2,5,6]. High drug resistant rate observed in this study will add further problem for pregnant women treatment due to the fact that bacteriuria, cystitis, vaginitis and pyelonephritis are the most common cause of urogenital infections [8,10], and asymptomatic infection could be caused by other factors such as abortion, still birth and thrombosis [3,5,6]. Pyelonephritis reported to cause significant maternal and fetal morbidity and mortality [3,10]. It is worth mentioning that asymptomatic infection could be easily transfer to symptomatic infection if it is not treated probably [5], and will lead to infant morbidity and mortality if poorly diagnosed [57,58]. This is in agreement with other studies showed that other physiological changes during pregnancy such as hormonal changes provide the ideal environment for UTI-causing bacteria (*E. coli*) and increase rate of infection, likewise vagina of the pregnant women work as niche for bacterial and Candida growth due to moisture habitat and rich glycogen content [59]. Also sexually active women are more susceptible to UTI [60]. Therefore, all these factors will increase rate of UTI infection in women more than men. Adding to that the remarkable resistant of these isolates in this study is of great concern for limiting availability of drugs used for treatments and further consideration for laying out base line for future treatments to avoid invention of new MDR strains.

The overall antimicrobial activity pattern showed that meropenem, Imipenem and levofloxacin is the most effective antibiotic with rate of 100.0% Table 4. This encourage prescribing these antibiotic for UTI under good surveillance system in order to increase their life spam [24,25]. Moreover, recommendation for educational policy to reduce prevalence of UTI and to improve quality of health services in term of prevention and treatment services and drug prescribing policy for pregnant is of high concern. Therefore, routine screening of pregnant women for UTI followed by culturing and sensitivity test for appropriate antimicrobial selection to render further complications.

References

- Prakash D, Saxena RS (2013) Distribution and antimicrobial susceptibility pattern of bacterial pathogens causing urinary tract infection in urban community of Meerut city, India. ISRN Microbiology ID 749629. doi: 10.1155/2013/749629.
- Onwuezobe IA, Orok FE (2015) The bacterial isolates and plasmid profile of extended spectrum Beta-Lactamase producing bacteria causing urinary tract infection among pregnant women in You, Nigeria. Journal of Biosciences and Medicines 3(7): 25-30.
- Matuszkiewicz-Rowińska J, Małyško J, Wieliczko M (2015) Urinary tract infections in pregnancy: old and unresolved diagnostic and therapeutic problems. Arch Med Sci 11(1): 67-77.
- Al-ghalibi SM, Al-Moayad E, Al-Jaufy A (2007) Bacterial urinary tract infection among pregnant women in Sana'a city-Yemen. Arab Gulf J of Scientific research 25(1-2): 23-31.
- Sujatha R, Nawani M (2014) prevalence of a symptomatic bacteriuria and its antibacterial susceptibility pattern among pregnant women attending the antenatal clinic at Kanpur, India. J Clin Diag Res 8(4): DC01- DC03.
- Anyadoh SO, Akerele J, Udum U (2010) Prevalence of multidrug resistant Escherichia coli among pregnant Women in Owerri. IJMST 3(3): 17-20.
- Lee M, Bozzo, P, Einarson A, Koren G (2008) Urinary tract infections in pregnancy. Can Fam Physician 54(6): 853-854.
- Anyadoh-Nwadike SO, Sylvester I, Okorondu SI, Ifeany OC, Obiajuru O, et al. (2015) Comparative Study of the Prevalence and Antibiogram of Bacterial Isolates from the Urinary and Genital Tracts of Antenatal Patients. IOSR-JPBS 10(1): 15-19.
- Ayoade E, Moro DD, Ebene OL (2014) Prevalence and antimicrobial susceptibility pattern of asymptomatic urinary tract infections of bacterial and parasitic origins among university students in redemption camp, Ogun state, Nigeria. Open J of medical Microbiology 3: 219-226.
- Okonko LO, Ijandipe LA, Ilusanya AO, Donbraye-Emmanuel OB, Ejembi J, et al. (2010) Detection of Urinary Tract Infection (UTI) among pregnant women in Oluyoro Catholic Hospital, Ibadan, South-Western Nigeria Malaysian Journal of Microbiology 6(1): 16-24.
- Clani O, Grassi D, Tarriconi R (2013) An Economic perspective on Urinary tract infection: the "costs of resignation". Clin Drug 23(4): 255-261.
- Foxman B (2002) Epidemiology of urinary infections: incidence, morbidity and economic costs. Dis Mon 49(2): 53-70.
- Aiyegoro OA, Igbinsosa OO, Ogunmwoyi IN, Odjadjare EE, Igbinsosa OE, et al. (2007) Incidence of urinary tract infections (UTI) among children and adolescents in Ile-Ife, Nigeria. African Journal of Microbiology Research 1: 13-19.
- Macejko AM, Schaeffer AJ (2007) Asymptomatic bacteriuria and symptomatic urinary tract infections during pregnancy. Urol Clin North Am 34(1): 35-42.
- Obinkorang C, Quayel L, Bio FY, Amidu N, Acheampong I, et al. (2012) Asymptomatic bacteriuria among pregnant women attending antenatal clinic at the University Hospital Kumasi, Ghana. J med Biomed Res 1(1): 38-44.
- Kolawole AS, Kolawole OM, Kandaki-Olukemi YT, Babatunde SK, Durowade KA, et al. (2009) Prevalence of urinary tract infections (UTI) among patients attending DalhatuAraf Specialist Hospital, Lafia, Nasarawa State, Nigeria. International Journal of Medicine and Medical Sciences 1(5): 163-167.
- Lane DR, Takhar SS (2011) Diagnosis and management of urinary tract infection and pyelonephritis. Emerg Med Clin North Am 29(3): 539-552.
- National Institute for Health and Clinical Excellence: Guidance (2008)

- antenatal care: routine care for the healthy pregnant women. RCOG Press, London, UK.
19. Masinde A, Gumodoka B, Kilonzo A, Mehana SE (2009) Prevalence of urinary tract infection among pregnant women at Bugando Medical Centre, Mwanza, Tanzania. *Tanzan J Health Res* 11(3): 154-159.
 20. Amin FN, Rooshan MH, Ahmady MH, Sohamani MJ (2009) Hygiene practices and sexual activity associated with urinary tract infection in pregnant women. *East Mediterr Health J* 15(1): 104-110.
 21. National Institutes of Health (NIH) (2004) What I need to know about Urinary Tract Infections. NIH Publication No. 04-4807.
 22. Rane A, Dasgupta R (2013) Urinary Tract Infection: Clinical perspective urinary tract infection. Springer London Heidelberg, New York, USA.
 23. American Academy of Family Physicians (AAFP) (2004) Urinary tract infections: A common problem for some women.
 24. NIH (2005) Fact sheet: Urinary Tract Infections in Adults. NIH Publication No.06-2097.
 25. Karlowsky JA, Hoban DJ, Decorby MR, Laing NM, Zhanel GG (2006) Fluoroquinolone resistant urinary isolates of *Escherichia coli* from our patients are frequently multi-drug: Results from the North American urinary tract infection collaborative alliance-quinolone resistance study. *Antimicrob Agents Chemother* 50(6): 2251-2254.
 26. Solberg OO, Ajiboye RM, Riley LW (2006) Origin of class 1 and 2 integron and gene cassettes in a population-based sample of uropathogenic *Escherichia coli*. *J Clin Microbiol* 44(4): 1347-1351.
 27. White B (2011) Diagnosis and treatment of urinary tract infection in children. *Am Fam Physician* 83(4): 409-415.
 28. Tantry BA, Rahiman S (2012) Antimicrobial resistance and trend of urinary tract pathogens to commonly used antibiotic in Kashmir. *West Indian Med J* 61(7): 703-707.
 29. Osuala FOU, Anyadoh SO, Nnoli MC (2005) Antibacterial activity of two local medicinal plants, Utazi (*Gongronena latifolium*) and Nchuanwu (*Ocimum gratissimum*). *International Journal of Natural and Applied Sciences* 1(1): 36 -39.
 30. Todar K (2009) *Todar's Online Textbook of Bacteriology*. Wisconsin, USA.
 31. Smith PJ, Morris AJ, Reller LB (2003) Predicting urine culture results by dipstick testing and phase contrast microscopy. *Pathology* 35(2): 161-165.
 32. Cheesbrough M (2006) *Medical laboratories manual for tropical countries*. (2nd edn), Cambridge University Press, London, UK, pp. 479.
 33. Cheesbrough M (2005) *District laboratory practice in tropical countries*. Cambridge University Press, London, UK, pp. 357.
 34. Prescott ML, John PH, Donald AK (2005) *A Textbook of Microbiology*. (6th edn), McGraw Hill, New York, USA.
 35. Prescott M, Harley P, Klein A (2008) *Microbiology*. (7th edn), McGraw-Hill, New York, USA.
 36. Jamieson DJ, Theiler RN, Rasmussen SA (2006) Emerging infections and pregnancy. *Emerg Infect Dis* 12(11): 1638-1643.
 37. Imade PE, Eghafona NO (2010) Incidence of bacteriuria in antiretroviral-naïve HIV positive children less than five years of age in Benin City, Nigeria. *Libyan J Med* 5. doi: 10.4176/090910.
 38. Onifade AK, Omoya FO, Adegunloye DV (2005) Incidence and control of urinary tract infections among pregnant women attending antenatal clinics in government hospitals in Ondo State, Nigeria. *Journal of Food, Agriculture and Environment* 3(1): 37-38.
 39. Ibeawuchi R, Mbata TI (2002) Rational and irrational use of antibiotics. *African Health* 24: 16-18.
 40. Asinobi AO, Fatunde OJ, Brown BJ, Osinusi K, Fasina NA (2003) Urinary tract infection in febrile children with sickle cell anaemia in Ibadan, Nigeria. *Ann Trop Paediatr* 23(2): 129-134.
 41. Olaitan JO (2006) Asymptomatic bacteriuria in female student population of a Nigerian University. *The Internet Journal of Microbiology* 2(2).
 42. Mbata TI (2007) Prevalence and antibiogram of UTIs among prisons inmates in Nigeria. *The Internet Journal of Microbiology* 3(2).
 43. Khan S, Rashmi M, Singh M, Siddiqui Z, Ansari M (2015) Pregnancy associated asymptomatic bacteriuria and drug resistance. *J Taibah University Medical science* 10(3): 340-345.
 44. O'Dell KK (2011) Pharmacological management of asymptomatic bacteriuria and urinary tract infection in women. *J Midwifery Womens Health* 56(3): 248-265.
 45. Parveen K, Momen A, Ara Begum A, Begum M (2011) Prevalence of urinary tract infection during pregnancy. *J Dhaka National Med Coll Hos* 17(2): 8-12.
 46. Kahlmeter G, ECO.SENS (2003) An international survey of the antimicrobial susceptibility of pathogens from uncomplicated urinary tract infection: the ECO. SENS Project. *J Antimicrob Chemother* 51(1): 69-76.
 47. Onuh SO (2006) Microbiological Isolates and sensitivity pattern of urinary tract infection in pregnancy in Benin City, Nigeria. *Ebony Medical Journal* 5(2): 48-52.
 48. Celen S, Oruç AS, Karayalçın R, Saygan S, Unlü S, et al. (2011) Asymptomatic bacteriuria and susceptibility patterns in an obstetric population. *ISRN Obstet Gynecol* 2011: 721872.
 49. Nwanze PI, Nwaru LM, Oranusu S, Dimkpa U, Okwu MU, et al. (2007) Urinary tract infection in Okada village: Prevalence and antimicrobial susceptibility pattern. *Scientific Research and Essay* 2(4): 112-116.
 50. Lammers O, Harder CK (2011) Appropriate management of urinary tract infection and asymptomatic bacteriuria. Urinary tract infections and asymptomatic bacteriuria published by the VHA antimicrobial review subcommittee of the pharmacy and therapeutic committee.
 51. Robinson JL, Finaly JC, Lange ME, Bortolussi R, Canadian Paediatric Society, Community Paediatrics Committee, Infectious Diseases and Immunization Committee (2015) Prophylactic antibiotics for children with recurrent urinary tract infections. *Paediatr Child Health* 20(1): 45-51.
 52. Robinson JL, Finaly JC, Lang ME, Bortolussi R, Canadian Paediatric Society, Infectious Diseases and Immunization Committee, Community Paediatrics Committee (2014) Urinary tract infection in infant and children: Diagnosis and management. *Paediatr Child Health* 19(6): 315-319.
 53. Imade PE, Izeke PE, Eghafona NO, Enabulele OI, Ophori E (2010) Asymptomatic bacteriuria among pregnant women. *N Am J Med Sci* 2(6): 263-266.
 54. Momoh ARM, Odike MAC, Olowo S, Monoh AA, Okolop O (2007) Resistance pattern of urinary tract infection bacterial isolates to selected quinolones. *Benin Journal of postgraduate Medicine* 9(1): 22-27.

55. Nys S, van Merode T, Bartelds AI, Stobberingh EE (2006) Urinary tract infections in general practice patients; diagnosis tests versus bacteriological culture. *J Antimicrobial Chemother* 57(5): 955-958.
56. Mokube MN, Atshili J, Halle-Ekane GE, Ikomey GM, Ndumbe PM (2013) Bacteriuria amongst pregnant women in buea Health District, Cameroon: prevalence, predictors, antibiotic susceptibility pattern and diagnosis. *PLOS one* 8(8): e71086.
57. Moulds RFW, Jeyasingham MS (2010) Gentamicin: a great way to start. *Australia Prescriber* 33(5): 134-135.
58. Nicolle LE, Bradley S, Colgan R, Rice JC, Schaeffer A, et al. (2005) Infectious Diseases Society of America guidelines for the diagnosis and treatment of asymptomatic bacteriuria in adults. *Clin Infect Dis* 40(5): 643-654.
59. Homeier BP (2004) Ten things that might surprise you about being pregnant.
60. Ani OC (2008) Prevalence of urinary tract infections (UTI) in sexually active women of Abakaliki, Ebonyi state, Nigeria. *Animal Research International* 5(2): 876-879.