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PREVALENCE OF URINARY TRACT INFECTION AMONG PREGNANT WOMEN INADEN CITY-YEMEN

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ABSTRACT

Background: Symptomatic and asymptomatic bacteriuria (ASB) is common in pregnant women. Pregnancy will enhance the progression of cases from ASB to symptomatic bacteriuria, which if left untreated, could lead to maternal & infant complications. A higher incidence of perinatal problems in pregnant women occurs with ASB. Acute pyelonephritis and other adverse outcomes such as prematurity-postpartum hypertensive disease, anaemia, Urinary tract infections (UTIs) and higher fetal mortality rates were occurred with ASB. **Aims:** To identify the prevalence of ASB, the most common causative microorganisms and the antibacterial susceptibilities of the isolated microorganisms at a Maternal-Child Health Care & Al-SADAQ Teaching Hospital in Aden city-Yemen. **Subjects and Methods:** A total number of 150 pregnant women were screened for either having symptoms of UTIs or not by questionnaire. The type of the study was a cross sectional study conducted from the 1st of December 2018 up to 1st of April 2019. Urine was obtained for culture, and then the isolated bacteria were subjected to the most common antibiotics used in such cases. **Results:** Out of 150 pregnant women the mean age was 24.4 (±4.8 SD), the minimum and the maximum age of such participants were 15-43 year with rang of 28 year. The overall UTI was 64(42.7%); the asymptomatic UTI among the pregnant women was (4.7%). The most isolated bacteria were *E. coli* 57/150(38%), followed by *Staphylococcus aureus* 5/150(3.3%). *Escherichia coli* were found to be sensitive to Imipenem & Ceftriaxone 100% & 96.5%, respectively, followed by Ciprofloxacin & Norfloxacin 98.2%. The least sensitivity was for Amoxicillin 22.8%. **Conclusion:** The prevalence of UTI among pregnant women was high, particularly *E. coli*. Asymptomatic bacteriuria was detected among pregnant women so early screening of ASB is

essential to reduce maternal and child complications. Every positive case should be treated with appropriate antibiotic therapy.

KEYWORDS: Symptomatic, asymptomatic bacteriuria, Prevalence, *E. coli*, *Staphylococcus aureus*, pregnant women, Aden.

INTRODUCTION

Asymptomatic bacteriuria (ASB) is the second principal bacteria associated infections in primary health care. *(Biadglegne & Abera, 2016)* It affects millions of people globally, especially in developed countries. *(Ranjan, et al., 2017).*

Asymptomatic bacteriuria is defined as the presence of active bacteria in the urine of an individual without apparent signs or symptoms of a urinary tract infection (UTI). ASB has been shown to be a significant predictor of UTI, with prevalence rates ranging from 5–6% in healthy women 18–40 years of age and up to 20% in the ambulatory elderly. (Hooton, 2012) While some studies (Alfred, et al., 2013 & Elzayat, et al., 2017) have reported the overall prevalence of ASB particularly in pregnancy to be between 10% and 40%, a few studies have also reported different prevalence rates of ASB ranging from 13.3% to 28.8%. (Labi, et al., 2015).

The physiological changes associated with pregnancy, such as the relaxation of the ureter under the effect of hormones, increase the urinary output, resulting in urinary stasis. (Sheikh, et al., 2000) In addition, mechanical compression from the enlarging uterus is the principle cause of hydroureter and hydronephrosis. Differences in urine pH and osmolality and pregnancy-induced glycosuria and aminoaciduria may facilitate bacterial growth. (Jeyabalan & Lain, 2007) Moreover, women are mostly at risk for ASB due to the short nature of their urethra, and some social factors that include personal hygiene and sexual activity. (Platt & Keating, 2007; Foxman, 2013).

Bacteria which is present in digestive tract, vagina or around the urethra (entrance to the urinary tract) can also cause UTI, mostly they enters the urethra and then travel to bladder and kidneys. (Al-Haddad, 20005 & Masinde, et al., 2009).

Justification of the study

No published data are available about prevalence of UTI among pregnant women in Aden city-Yemen. Therefore, the present study was conducted to identify the prevalence of UTIs

among pregnant women and the etiological agents along with anti-microbial susceptibility patterns in those attending Maternal-Child Health Care & AL-SADAQA Teaching Hospital in Aden city-Yemen.

SUBJECTS AND METHODS

The total of 150 pregnant women either with or without symptoms of UTI was enrolled in the study. Questionnaires were administered to obtain socio-demographic data and obstetric data. Moreover, Questionnaires of the signs and symptoms associated with UTI: pain or burning sensation during urination, frequent urination, and feeling of urgency, blood or mucus in the urine, cramps or pain in the lower abdomen, pain during sexual intercourse, pain, pressure or tenderness in the area of the bladder. When bacteria spread to the kidneys patient may experience: back pain, chills, fever, nausea and vomiting. (Franklin & Monif, 2000; Okonko, et al., 2010).

Inclusion criteria

1. Pregnant women that attending to Maternal-Child Health Care & AL-SADAQA Teaching Hospital in Aden city-Yemen with or without symptoms of UTI.
2. Pregnant women without antibiotic treatment (for any Cause).

Exclusion criteria

1. Pregnant women on antibiotic therapy taken in the previous two weeks.
2. Pregnant women on catheter and those in labour as well as those came after delivery.
3. Pregnant women with renal abnormality or renal calculi.

Sample collection, Counting & Identification

The pregnant women were counseled and instructed about the collection of "clean catch" mid-stream sample of urine into sterile wide mouthed container that was covered with a tightly fitted lid. Ten mL was transferred to sterile centrifuge tubes and then centrifuged at 3000 rpm for 10–15 minutes. The supernatant was discarded and 1 mL of the precipitate was resuspended in residual urine by shaking vigorously. With a calibrated micro-loop, 0.02 ml of urine was cultured on to a Nutrient agar, MacConkey agar, Blood agar, DNase agar and Cystine lactose electrolyte-deficient (CLED) agar plates. After overnight incubation at 37^0C for 24 hours, colonies were counted and a bacterial growth of $\geq 10^5$ /ml of centrifuged urine was taken as being significant in both symptomatic and asymptomatic pregnant women. The

organisms were identified based upon the cultural, morphological and biochemical characteristics, using the Cowan and Steel method. (Cowan and Steel, 1993).

Antibiotic susceptibility testing

The 63 isolated bacteria were tested for sensitivity test using the Kirby–Bauer disc diffusion method according to CLSI guidelines (CLSI, 2012). The gram negative isolated bacteria was tested for susceptibility pattern using the following antibiotics: Amoxicillin (AM, 20µg), Amoxicillin + Clavulanic acid (AMC 20µg/10µg), Ceftriaxone (CTR, 30µg), Cephalexin (CN, 30µg), Ciprofloxacin (CIP, 5µg), Norfloxacin (NX, 10µg), Ofloxacin (OF, 5µg) and Imipenem (IPM, 10µg). The gram positive bacteria were subjected to the same antibiotics but instead of Ofloxacin and Norfloxacin were substituted by Lincomycin (L, 2µg) & Azithromycin (AZM, 15µg).

Ethical considerations

Ethical approval for the study was given by the Ethics Review Committee at University of Science & Technology-Aden branch, also from Ministry of Health, Aden-Republic of Yemen. An informed consent was obtained before collection of urine specimens and results were used in the management of patients.

Statistical analysi

The results data will be entered in to SPSS program version 20 and descriptive statistic will be used to summaries the data, like tables, figures, and measures of central tendency. Analytic statistics will be used to compare between the variables. Chi-square (X^2) will be used, significance will be assumed at $P \leq 0.05$.

RESULTS

Out of 150 pregnant women the mean age was 24.4 (±4.8 SD), the minimum and the maximum age of such participants were 15-43 year with rang of 28 year. The frequency of age groups were seen at 21-26 years followed by 15-20 years in percentage of 35.3% & 22.7%, respectively, while the lowest age group was those women at age of ≥ 39 years 12(8%). Table (1)

The education level

Majority of women tested 49(32.7%) were educated up to the secondary school, followed by primary & university levels of education 45(30%) & 35(23.3%), respectively, while 21(14%) represented the illiteracy women (Table 1).

Table 1: Socio-demographic and Obstetric characteristics of 150 pregnant women.

Age Groups (Year)	Frequency	Percent
15-20	34	22.7
21-26	53	35.3
27-32	28	18.7
33-38	23	15.3
≥ 39	12	8
Education level		
illiteracy	21	14.0
Primary level	45	30.0
Secondary level	49	32.7
University level	35	23.3
Trimester level		
First Trimester	45	30.0
Second Trimester	46	30.7
Third Trimester	59	39.3
Parity		
Primigravida	62	41.3
Second gravida	41	27.3
Multigravida	47	31.3

The gestational age

The frequency of the gestational age of the pregnant women since it divided into first trimester, second trimester & full term (i.e. third trimester) was 45(30%), 46(30.7%) and 59(39.3%), respectively, Table (1).

Number of conception (Parity)

There was an increase in the percentage of the number of parity in primigravida, followed by the multigravida & the least on was seen in the second gravida (41.3%, 31.3% & 27.3%), respectively, Table (1). In addition, the women bearing male or female embryo was identified in those women having documented ultrasonography. Out of the 150 cases only 9(6%) was having male conception, 7(4.7%) was having female conception & the rest 134(89.3%) of women were not have such document (Fig. 1).

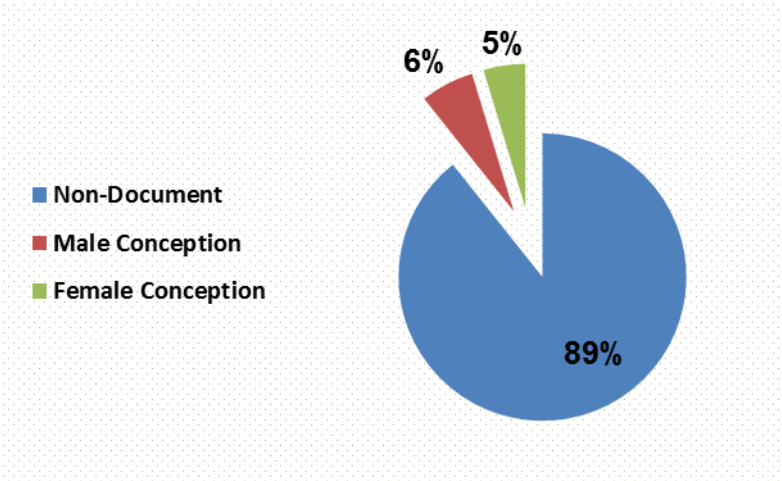

Figure 1: % of Women Bearing Male or Female embryo.

Out of 150 tested pregnant women the frequency of the clinical signs and symptoms of UTI as mentioned before was counted we found 61(40.7%) were asymptomatic, while 89(59.3%) were symptomatic (Fig. 2).

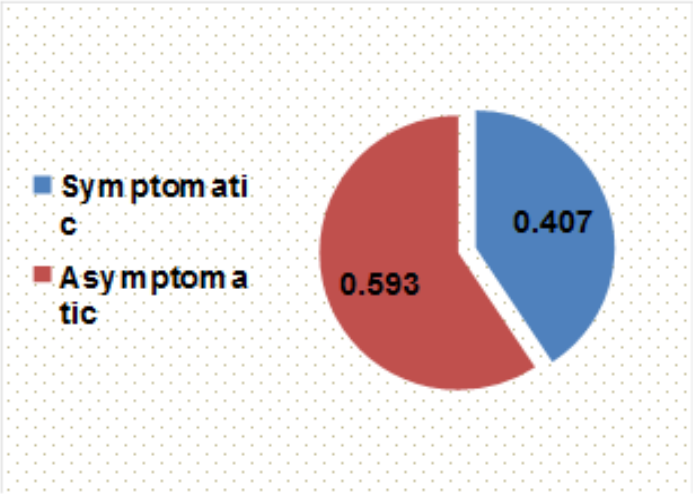

Figure 2: Frequency of pregnant women with or without symptoms of UTI.

The significant growth of bacteria (Figure 3) was counted among the pregnant women, based on the total number of colonies on the plates (i.e. $\geq 10^5$/ml) considered as significant growth, there was 86(57.3%) as Non-significant growth (i.e. UTI was Negative) & 64(42.7%) was Significant growth (i.e. UTI was Positive). Out of the 64 that was significant growth; one of them was significant growth of *Candida albicans* & the remaining 2 cases were belonged to the Non-significant growth, as seen in Table (4).

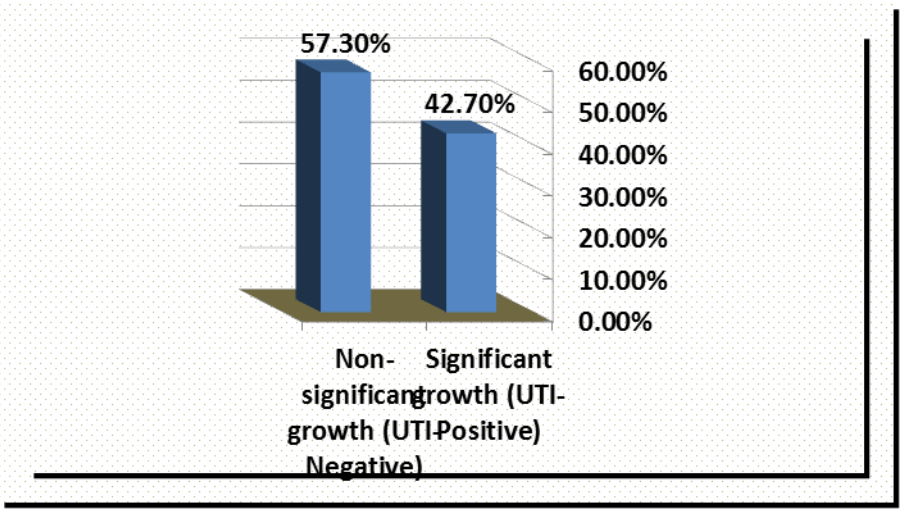

Figure 3: Frequency of Significant (Positive UTI) & Non-significant Growth (Negative UTI) among the 150 Pregnant Women.

The distribution of the different isolates were evaluated Table (2). *E. coli* was the predominant bacteria isolated, followed by *Staphylococcus aureus*, *Candida albicans* & the least percentage was *Group B β-hemolytic Streptococcus agalactiae* (GBSA); 57(38%), 5(3.3%), 3(2%) & 1(0.7), respectively. Regarding *Candida albicans*, two cases of *Candida albicans* belong to the non-significant growth & the remaining one was belonged to the significant growth.

Table 2: Frequency the most common isolates.

	Frequency	Percent
Non-significant growth	84	56
E. coli	57	38
Staphylococcus aureus	5	3.3
Candida albicans	3	2
Group B Streptococcus agalactiae	1	0.7
Total	150	100

The association between the significant growth of bacteria (Positive-UTI), based on the total number of colonies to the symptomatic & asymptomatic women was evaluated it showed a highly statistical significant *(P=0.000)*, Table (3). Asymptomatic bacteriuria (ABU) & symptomatic bacteriuria (SB) was 3(4.7%) & 61(40.7%), respectively.

Table 3: The Association Between the Significant & Non-Significant Growth of bacteria with the symptomatic & asymptomatic women.

	Asymptomatic	Symptomatic	Total
NSG-Colonies≤10^5 /ml: (Negative-UTI)	86(100%)	0(.0%)	86(100%)
SG-Colonies ≥10^5 /ml: (Positive-UTI)	3(4.7%)	61(95.3%)	64(100%)
Total	89(59.3%)	61(40.7%)	150(100%)

(X^2=1.381, df=1, P=0.000). Non-significant growth (NSG), significant growth (SG)

The association between the non-significant & significant growth of bacteria with the type of isolates was evaluated it showed a statistical significant *(P=0.000)*, Table (4).

Table 4: The Association between the Significant Growth & the Isolates.

	NSG	*E. coli*	*C. albicans*	*GBSA*	*S. aureus*	*Total*
NSG-Colonies≤10^5 /ml	84(97.7%)	0(.0%)	2(2.3%)	0(.0%)	0(.0%)	86(100%)
SG-Colonies ≥10^5 /ml	0(.0%)	57(89.1%)	1(1.6%)	1(1.6%)	5(2.3%)	64(100%)
Total	84(59%)	57(38%)	3(2%)	1(0.7%)	5(3.3%)	150(100%)

(X^2=1.473, df=4, P=0.000). Non-significant growth (NSG), significant growth (SG), Group B Streptococcus agalactiae (GBSA)

The prevalence of UTIs in relation to age of pregnant women was evaluated by *Chi-Square test*, there was a statistical significant *(P=0.03)*. A higher percentage of pregnant women having UTI were at the age groups ≥ 39 years followed by those at age of 27-32 years with percentage 83.3% & 50%, respectively (Table 5).

Table 5: The Prevalence of UTI in relation to age distributions of pregnant women.

Age Group (Years)	Negative-UTI	Positive-UTI	Total
15-20	21(61.8%)	13(38.2%)	34(100%)
21-26	33(62.3%)	20(37.7%)	53(100%)
27-32	14(50%)	14(50%)	28(100%)
33-38	16(69.6%)	7(30.4%	23(100%)
≥ 39	2(16.7%)	10(83.3%)	12(100%)
Total	86(57.3%)	64(42.7%)	150(100%)

X^2=10.935, df=4, P=0.03

The prevalence of UTIs in relation to the other socio-economic & obstetric characteristics was evaluated. The association between the UTI and the levels of education show no statistical significant *(X^2=1.273, df=3, P=0.7)* with eventual distribution of UTI among

secondary, primary & university levels 23(46.9%), 20(44.4%) & 14(40%), respectively. However, the least UTI was seen in illiteracy women 7(33.3%), as shown in Table 6.

Table 6: The Relationship between UTI & Levels of education.

Educational Levels	Not UTI	UTI	Total
illiteracy	14(66.7%)	7(33.3%)	21(100%)
Primary level	25(55.6%)	20(44.4%)	45(100%)
Secondary level	26(53.1%)	23(46.9%)	49(100%)
University level	21(60%)	14(40%)	35(100%)
Total	86(57.3%)	64(42.7%)	150(100%)

X^2=1.273, df=3, P=0.7

The association of UTI with the gestational age, the parity & the type of conception either male or female were evaluated it show no statistical significant (*X^2=1.478, df=2, P=0.5, X^2=0.336, df=2, P=0.8 & X^2=2.730, df=2, P=0.32)*, respectively, (Table 7).

Table 7: The association of UTI with the obstetric characteristics.

Gestational age	Not UTI	UTI	Total	P-Value
First Trimester	29(64.4%)	16(35.6%)	45(100%)	**0.5**
Second Trimester	24(52.2%)	22(47.8%)	46(100%)	
Third Trimester	33(55.9%)	26(44.1%)	59(100%)	
Total	**86(57.3%)**	**64(42.7%)**	**150(100%)**	
Parity	**Not UTI**	**UTI**	**Total**	**P-Value**
Primigravida	36(58.1%)	26(41.9%)	62(100%)	**0.8**
Secondgravida	22(53.7%)	19(46.3%)	41(100%)	
Multigravida	28(59.6%)	19(40.4%)	47(100%)	
Total	**86(57.3%)**	**64(42.7%)**	**150(100%)**	
Type of Conception	**Not UTI**	**UTI**	**Total**	**P-Value**
Not Documented	78(58.2%)	56(41.8%)	134(100%)	**0.3**
Male Conception	3(33.3%)	6(66.7%)	9(100%)	
Female Conception	5(71.4%)	2(28.6%)	7(100%)	
Total	**86(57.3%)**	**64(42.7%)**	**150(100%)**	

The susceptibility pattern of the most common isolated bacteria

The Susceptibility Pattern of the Gram Negative Isolated Bacteria *(E. coli)* to the Antimicrobial Agents. Out of 150 cultured urine specimens, 63 cases were subjected to sensitivity testing. Since the most isolated bacteria was *E. coli* 57(38%), followed by *Staphylococcus aureus & Group B β-hemolytic Streptococcus agalactiae* 5/150(3.3%) & 1/150(0.7), respectively as mentioned before in table (2). The pattern of susceptibility was seen in table (8).

Table 8: The susceptibility pattern of the E. coli to the antimicrobial agents.

	Susceptibility Pattern of E. coli							
	AM	**AMC**	**CTR**	**CN**	**CIP**	**NX**	**OF**	**IPM**
R	44(77.2%)	14(24.6%)	2(3.5%)	4(7%)	1(1.8%)	1(1.8%)	9(15.8%)	0(0.0%)
S	13(22.8%)	43(75.4%)	55(96.5%)	53(93%)	56(98.2%)	56(98.2%)	48(84.2%)	57(100%)
Total	57(100%)	57(100%)	57(100%)	57(100%)	57(100%)	57(100%)	57(100%)	57(100%)

R: Resistant, S: Sensitive, Amoxicillin (AM, 20µg), Amoxicillin + Clavulanic acid (AMC 20µg/10µg), Ceftriaxone (CTR, 30µg), Cephalexin (CN, 30µg), Ciprofloxacin (CIP, 5µg), Norfloxacin (NX, 10µg), Ofloxacin (OF, 5µg) and Imipenem (IPM, 10µg).

The susceptibility pattern of Gram Positive bacteria

The Gram positive bacteria isolated was 5 cases: *Staphylococcus aureus* & one case: *Group B β-hemolytic Streptococcus agalactiae*. They were subjected to the susceptibility testing by using the same antibiotics but instead of Ofloxacin and Norfloxacin were substituted by Lincomycin (L, 2µg) & Azithromycin (AZM, 15µg).

The overall sensitivity pattern of *Staphylococcus aureus* to AM & AMC was 0/5(0.0%, 3/5(60%), respectively. The sensitivity was 4/5(80%) for CN, CIP, L & AZM, while it (100%) for CTR & IPM. The susceptibility pattern of *Group B Streptococcus agalactiae* (GBSA) to all antibiotics was 100% sensitive.

DISCUSSION

One of the biggest risk factors for symptomatic infection is asymptomatic bacteriuria. If asymptomatic bacteriuria is left untreated 30% of mothers develop acute pyelonephritis compared with 1·8% of non-bacteriuric controls. *(John, & Michael, 2000)* . *Obiogbolu, et al. (2009)* stated that bacterial UTI represents the most common bacterial infection during pregnancy. Out of 150 pregnant women the frequency of age groups were seen at 21-26 years followed by 15-20 years in percentage of 35.3% & 22.7%, respectively, while the lowest age group was those women at age of ≥ 39 years 12(8%), (Table 1), this explain the marriage & conception was occurred early in our country. The total number of examined women that have symptoms of UTI in compare with asymptomatic women was 61/150(40.7%) & 89/150(59.3%), respectively, (Figure 2).

In our study the frequency of UTI among pregnant women was 64/150(42.7%), (Figure 3). This high percentage was explained by *Sheikh, et al., (2000)* who reported that the physiological changes associated with pregnancy, such as the relaxation of the ureter under

the effect of hormones, increase the urinary output, resulting in urinary stasis. Our result was unlike that reported by *Al-Haddad (2005)* in Al-Mukalla-Yemen, out of the 137 women tested, 41(30%) were positive for UTI, while 96 (70%) were negative. In Sana'a City-Yemen the prevalence rates of UTI in pregnant women was 24.3%, which less than our finding. ***(***Al-Ghalibi**,** et al., 2007*)* In India, out of 120 pregnant women, 35% of them had urinary tract infection. (Ranjan, et al., 2017).

The distribution of the different isolates was evaluated in our study Table (2). *E. coli* was the predominant bacteria isolated, followed by *Staphylococcus aureus*, *Candida albicans* & the least percentage was *Group B β-hemolytic Streptococcus agalactiae* (GBSA); 57(38%), 5(3.3%), 3(2%) & 1(0.7), respectively. This study was agreed with that reported by *Al - Haddad, (2005)* in which *E. coli* was the most frequently isolated strain, followed by *Staphylococcus aureus*, and disagreed with that reported by Al-Ghalibi, et al., (2007) in which the most common isolates were *Staphylococcus aureus* and *E. coli.*

The association between the significant growth of bacteria (Positive-UTI), based on the total number of colonies on the plates (i.e. $\geq 10^5$/ml) to the symptomatic & asymptomatic pregnant women was evaluated it showed a statistical significant *(P=0.000)*, Table (3). The prevalence of UTI among asymptomatic women was 3(4.7%) in our study, this was agreed with that reported by *Hazlina, et al., (2004)* in Malaysia in which the prevalence of ABU was 4.1%. While some studies *(Ajayi, et al., 2012; Alfred, et al., 2013 & Elzayat, et al., 2017)* have reported the overall prevalence of ASB particularly in pregnancy to be between 10% and 40%, a few studies have also reported different prevalence rates of ASB ranging from 13.3% to 28.8%. *(Labi, et al., 2015)*

The prevalence of UTIs in relation to age of pregnant women was evaluated by Chi-Square test, there was a statistical significant *(P=0.03)*. A higher percentage of pregnant women having UTI was at the age groups ≥ 39 years followed by those at age of 27-32 years with percentage 83.3% & 50%, respectively. Table (5) Many studies show advancing age as a risk factor for acquiring UTIs in pregnancy because there is decrease in glycogen deposition and reduction in the lactobacillus as a part of ageing process which enhances bacterial adherence and invasion by pathogens and make them more susceptible *(Nicolle, 2015).*

The level of education of the pregnant women under study with the UTI was evaluated in our study, there was no statistical significant association (P=0.7). However, there a steady

increase of UTIs from University level to illiteracy as seen in table (6). In addition, the association of UTI with the obstetric characteristics: gestational age, parity, type of conception was evaluated and show no statistical significant association (P=0.5, 0.8 & 0.3) respectively, table (7). This study was agreement with that study conducted by *Nabbugodi, et al., (2013)* who noted there was no association between maternal age, parity, gravidity, occupation & education with UTI in their study.

Out of 150 cultured urine specimens, 63 cases were subjected to sensitivity testing. Since the most isolated bacteria was *E. coli* 57(38%), followed by *Staphylococcus aureus & Group B β-hemolytic Streptococcus agalactiae* 5/150(3.3%) & 1/150(0.7), respectively as mentioned before in table (2). The Susceptibility Pattern of the Gram negative isolated bacteria *E. coli* to the antimicrobial agents was seen in table (8) it show a high sensitivity to Imipenem (IPM) & Ceftriaxone (CTR); (100%) & (96.5%), respectively, followed by Ciprofloxacin (CIP) & Norfloxacin (NX) in percentage (98.2%). The least sensitivity was for Amoxicillin (AM) (22.8%). *Al Haddad (2005)* in Yemen noted that the most frequently isolated strain was *E. coli* (41.5%) & was susceptible to Ampicillin/Sulbactam (71% susceptibility), Cefotaxime (71%), Ciprofloxacin (94%), Chloramphenicol (94%), Ceftizoxime (100%),) Ofloxacin (82%), and Amikacin (100%). In addition, our study was agreement with *Nabbugodi, et al., (2013)* in Kenya, who noted that the susceptibility pattern of Gram bacteria were sensitive to Amoxicillin-Clavulanic acid 100%, Ceftriaxone 100%, Imipenem 100%, Levofloxacin 100%, Ceftazidime 100%, Cefuroxime 81% & less sensitive to Gentamycin and Ampicillin (72% & 50%), respectively.

The overall sensitivity pattern of *Staphylococcus aureus* to AM & Amoxicillin + Clavulanic acid (AMC) was 0/5(0.0%, 3/5(60%), respectively, also the sensitivity was 4/5(80%) for CN, CIP, L & AZM, while it (100%) for CTR & IPM. The susceptibility pattern of *Group B Streptococcus agalactiae* (GBS) to all antibiotics mentioned before was 100% sensitive. However, such susceptibility pattern was not interested to be generalized as the low numbers of such isolates.

CONCLUSIONS

Asymptomatic bacteriuria (ASB) constitutes a big problem due to the increase in prevalence among pregnant women. It is therefore, necessary to increase awareness through public health education at antenatal clinics, as well as early and regular screening for uropathogens to prevent any maternal & child complications. The overall prevalence of UTI among

pregnant women was also high. *E. coli* was the predominant bacteria isolated, followed by *Staphylococcus aureus*. In view of changing patterns of bacterial resistance to common drugs, the importance of educating physicians on use of antibiotics accordingly to provide empirical therapy is important.

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