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Research Article

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Drug Susceptibility Pattern and Associated Factors of Bacteria Isolated from Urinary Tract Infection among Pregnant Women Attending Antenatal Care in Teaching Referral Hospital, Southeast Ethiopia

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Abstract

Background: *Urinary tract infection (UTI) is caused by bacteria from the digestive tract which climbs the opening of the urethra and begins to multiply to cause infection. UTI in pregnancy is associated with significant morbidity for both mother and baby. In most developing countries including Ethiopia, screening for UTI in pregnancy is not considered an essential part of Antenatal Care. This study aimed to assess the bacterial profile and antibiotic susceptibility pattern and associated risk factors among pregnant women in Madda Walabu University Goba Referral Hospital, Southeast Ethiopia.*

Methods: *An institution-based cross-sectional study was conducted from June-August, 2020 . A total of 234 pregnant women were enrolled; data were collected using a structured questionnaire by a trained interviewer. Urine samples were collected from all pregnant women and culture on cysteine lysine electrolytes deficiency medium. Data were analyzed using SPSS 20.0. Descriptive statistics were used to explain the study participants with relevant variables. Logistic regression was used for data comparison. P-value <0.05 was accepted as statistically significant.*

Results: *The overall prevalence of UTI was 23.9% among both asymptomatic and symptomatic groups. Of this screened midstream urine samples showed that 16% and 32.2%, had significant bacteriuria in the asymptomatic and symptomatic groups respectively. The prevalence of UTI was significantly associated with previous history of catheterization and urinary tract infection ($p<0.05$). E. coli was the most frequently isolated organism (42.9%) followed by coagulase-negative Staphylococcus (26.8%), and S. aureus (12.5%). Gram-negative and Gram-positive bacteria accounted for (59%) and (41%) respectively. Gram-negative isolates showed resistance to ampicillin, naldixic acid and trimethoprim/sulfamethoxazole. Also, all Gram-negative bacterial isolates revealed a high level of resistance against trimethoprim/sulfamethoxazole.*

Conclusion: *Significant bacteriuria has been observed from both symptomatic and asymptomatic pregnant women.*

The majority of the isolates were resistant to commonly prescribed antibiotics. This calls for an early screening of all pregnant women for UTI and those found to be infected need treatment with an appropriate drug to avoid complications.

Keywords: UTI, Bacterial profile, Drug susceptibility testing, Ethiopia

Introduction

Urinary tract infection (UTI) is an infection caused by the presence and growth of microorganisms anywhere in the urinary system. The source of these microorganisms is usually from the digestive system which climbs the urinary tract and starts to multiply to cause infection [1-3]. The range of infection varies, from asymptomatic (the bacteria present in urine but not show symptoms) to symptomatic (The bacterial infection shows symptoms). Due to short urethra, absence of prostatic secretion, pregnancy and easy contamination of the urinary tract with fecal flora women are more susceptible to UTI than men [4, 5]. In most developing countries including Ethiopia, screening for UTI in pregnancy is not considered an essential part of antenatal care. It has been estimated that globally symptomatic UTIs result in as many as seven million visits to outpatient clinics, one million visits to emergency departments, and 100,000 hospitalizations annually [6,7].

Due to several anatomical and hormonal changes, pregnant women are more susceptible to develop UTI. Perhaps if untreated, it can lead to serious obstetric complications, poor maternal and prenatal outcomes. Furthermore, it has been observed that asymptomatic bacteriuria can lead to cystitis and pyelonephritis which can lead to acute respiratory distress, transient renal failure, sepsis and shock during pregnancy [5, 8]. In pregnancy, pyelonephritis increases the risk of preterm labor and delivery which results in prematurity and low birth weight with high perinatal morbidity and mortality [9].

The causative agents of UTI most of the time are Gram-negative aerobic rods found in the digestive system. The most common are: *E. coli, K. pneumoniae, Enterobacter, Citrobacter, P. mirabilis,* and *P. aeruginosa.* Other common pathogens include *S. epidermidis, S. saprophyticus, Enterococcus species* and *Serratia* species which presumably result in UTI following colonization of the genito-urinary tract [10]. *E.coli* (60–70%), *Klebsiella* species (10%), *Proteus* species (5–10%) and *Pseudomonas* species (2–5%) are the dominant Gram-negative bacteria causing UTI. Among Gram-positive bacteria pathogens, Streptococcus species and Staphylococcus species are frequently isolated from cases of UTIs [11, 12].

Many factors were identified which aggravate the probability of acquiring UTI causing pathogens during pregnancy, including the history of UTI, sexual activity, history of catheterization, lower socioeconomic status, and multiparity [4, 13].

Antimicrobial resistance among bacteria is a worldwide problem. The situation in developing countries like Ethiopia is a particularly serious issue [7]. Resistance in antimicrobial drugs in bacteria can result from two mutually nonexclusive phenomenons: mutations in housekeeping structural or regulatory genes and the horizontal acquisition of foreign genetic information [14-16]. Treatment of UTIs cases is often started empirically and therapy should be based on information determined from the antibiotic resistance pattern of the identified isolates. However, a large proportion of uncontrolled antibiotic usage has contributed to the emerging of resistant bacterial infections. As a result, the prevalence of antibiotic resistance among uro-pathogens has been rising worldwide [7].

Even though several studies have been made elsewhere, there are no similar previous studies conducted in Madda Walabu University Goba Referral Hospital (MWU GRH), where the antenatal care is provided for pregnant women. Therefore, this study was done to assess predominant isolates of uro-pathogens and their antibiotic susceptibility pattern and associated risk factors in pregnant women attending antenatal care in MWU GRH, Ethiopia. Also, this study was providing baseline information for further studies which will be conducted in the study area. The findings of the study were contributed to filling the gaps.

Methods

Study Design, Area and Participants

A hospital-based cross-sectional study was conducted at MWU GRH, which is located in Goba town, Oromia region, Southeast part of Ethiopia; 445 Km from Addis Ababa. This town has a latitude and longitude of 7°0′Nt 39°59′E and an elevation of 2,743 meters above sea level. This study was conducted from June to August, 2020. The study participants were all pregnant women who visited the MWU GRH during the study period and fulfilled inclusion criteria.

Sample Size and Sampling Technique

To determine the sample size single population proportion formula was used with the following assumptions: Based on the study conducted in Ambo, 18.7% prevalence of UTI was observed (3). Accordingly, the required sample size (n) was estimated with a confidence level of 95% and a 5% degree of precision. Thus the sample size was: 234

Sampling Technique

A systematic random sampling technique was used in pregnant women who visited the Goba referral hospital during the data collection period were included in the study.

Recruitment Procedure

Trained data collectors have approached all the pregnant women at the outpatient department of study sites, explain the purpose of the study and give out the study information sheet. For illiterate participants, the data collectors were read/other trusted individuals by the patient was read the information sheet. After allowing them to think and discuss attending all questions, the participants were asked to sign an informed consent in the presence of a literature witness.

Data Collection and Processing

Socio-demographic and clinical data related to UTI collected using

structured questionnaires. Ten ml freshly voided midstream urine specimens were collected and inoculated into CLED medium (Oxoid Ltd, Basingstoke, UK) using a calibrated wire inoculating loop (0.001ml). Cultures were incubated in an aerobic atmosphere at 37ºC for 24 hrs. Colonies were counted to check the presence of significant bacteriuria. Colony count yielding bacterial growth of 105CFU/ml of urine was regarded as significant bacteriuria [17]. All positive cultures have had identified at the species level by their colony characteristics, gram-staining reaction and by the pattern of biochemical tests using standard protocols. The Gram-negative rods were identified by indole production, H2S production, citrate utilization, motility test, urease utilization, and oxidase test. The gram-positive bacteria were differentiated using catalase and coagulase tests [14].

The drug susceptibility pattern of all identified pathogens of urine samples was done using the Kirby-Bauer disk diffusion technique according to the criteria of the Clinical and Laboratory Standards Institute method (CLSI 2018) [18]. Loopful bacterial colonies were taken from pure culture and transferred to a tube containing 5 ml of normal saline to adjust the density of a McFarland 0.5. The cotton swab was used to distribute the bacteria evenly over the entire surface of Mueller-Hinton agar (Oxoid Ltd). By using sterile forceps, the following concentration of antibiotic discs was put on the surface of Mueller-Hinton agar: ampicillin (AMP; 10µg), ceftriaxone (CRO; 30µg), Gentamycin (GEN; 10µg), trimethoprim-sulfamethoxazole (SXT; 25/125µg), Norfloxacin (NOR; 10µg), Nitrofurantoin (F; 300µg), Ciprofloxacin (CIP; 5µg), Nalidixic acid (NA; 30µg), Meropenem (MEM, 10µg), Clindamycin (CLD; 10µg), kanamycin (K; 30µg). Of these AMP, CRO, NA and MEM used only for Gram-negative bacteria, whereas CLD was used only for Gram-positive bacteria and the rest antibiotics were used for both isolates.

Data Quality Control Issue

The quality of data was assured by pre-testing of questionnaires on 20 participants in Robe hospital for assessing its clarity and to make amendments. The proper functioning of laboratory reagents and technical performance was checked daily by using reference strains (*E. coli* ATTC-25922, *S. aureus* ATTC-25923 and *P. aeruginosa* ATTC- 27853) before running patient samples and susceptibility testing and along with patient samples.

Data Processing and Analysis

All questionnaires were checked visually, entered and cleaned using Epi-Data Version-3.2 and exported to Statistical Package for Social Science (SPSS) version 20.0 windows for analysis. For controlling errors, the questionnaire was double entered; and also frequency checks were done. To explain the study population with relevant variables descriptive statistics (frequencies, mean, standard deviation, and percentage) were used. Logistic regression was used to assess the association between outcome and explanatory variables. Associations between dependent and independent variables were assessed and its strength was described using odds ratios and 95% confidence intervals. P-value <0.05 was accepted as statistically significant.

Ethical Consideration

Ethical clearance was obtained from the Madda Walabu University Institutional review board. Before any data collection, participants were informed about the aim of the study, about their right not to participate in the study or withdraw at any point in time and written consent was obtained. Personal privacy and dignity were respected. All samples and forms containing patient information were not having a name or information that can identify a particular participant.

Results

A total of 234 pregnant women with and without symptoms of UTI were investigated from July-August, 2019. The age of the study subjects ranged from 17 to 40 years with the majority (50%) in the age group of 15 to 24 years. The mean and median age was 24.94 and 24.5 years respectively. The majority of study participants were housewives (71.8%), followed by government employees (13.7%), urban dwellers (58.5%) and have 1501-2000 Ethiopian birr ($66.67) monthly income (31.2%). The educational status of participants varied from illiterate (26.1%) to college and above (12.4%). Among the study participants, (91.5%) were married and (68.4%) multigravida. Above 44% of the study subjects were in the second trimester (Table 1).

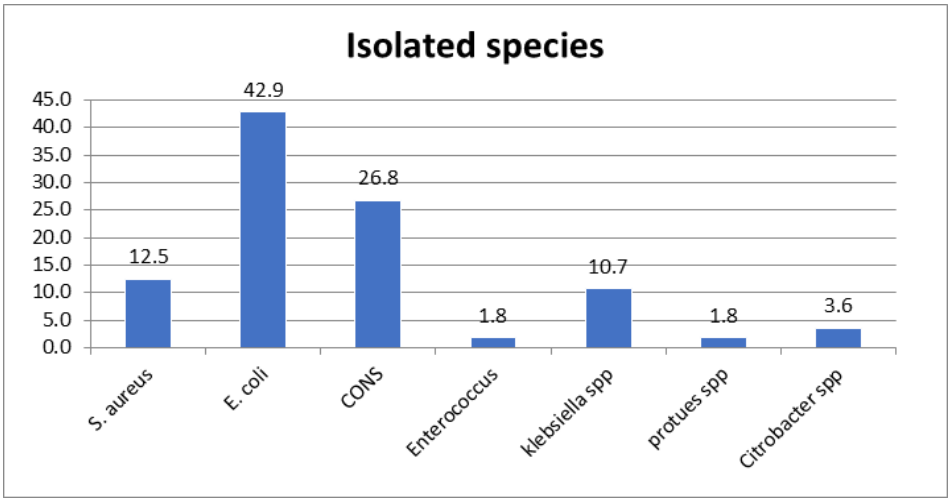
Table 1: Socio-demographic characteristics of study participants

Characteristic	Number	Percent
Age		
15-24	117	50
25-34	105	44.9
35-44	12	5.1
Residence		
Urban	137	58.5
Rural	97	41.5
Education level		
Illiterate	61	26.1
Read and write	24	10.3
Primary	59	25.2
Secondary	61	26.1
College & above	29	12.4
Monthly income (ETB)		
<500 ($16.67)	7	3
501-1000 ($16.7-33.33)	46	19.7
1001-1500 ($33.4-50)	60	25.6
1501-2000 ($50.03-66.67)	73	31.2
>2000 ($66.67)	48	20.5
Occupation		
Housewife	168	71.8
Employee	32	13.7
Merchant	23	9.8
Other	11	4.7
Marital status		
Married	214	91.5
Divorced	16	6.8
Widowed	4	1.7
Gestational stage		
First trimester	31	13.2
Second trimester	109	46.6
Third trimester	94	40.2
Gestational category		
Primigravida	74	31.6
Multigravida	160	68.4

Prevalence of UTI and Types of bacterial isolates

From cultured urine specimens, significant bacteriuria was isolated in 56 (19 from asymptomatic and 37 from symptomatic) pregnant women investigated for UTI. The prevalence of bacteriuria among symptomatic and asymptomatic pregnant women was 32.2% and 16% respectively, and the overall prevalence was 23.9%.

The percentage of each bacterium isolated from mid-stream urine samples is presented as shown in the figure below. Of the total 56 isolates, Gram-negative bacteria were prevalent (59%) than Gram-positive bacteria (41%). The major isolated pathogens were *E. coli* (42.9%), followed by coagulase-negative Staphylococci (CoNS) (26.8%) (Figure 1.).



CONS - Coagulase-negative Staphylococcus

Figure 1: Bacterial isolates among pregnant women in MWU GRH, Southeast Ethiopia.

Antimicrobial susceptibility testing of the isolates

Gram-Negative Bacteria

Gram-negative pathogens showed a high level of sensitivity to GEN (90.9%), and F (87.8%). Of these, E. coli in most clinical samples were highly sensitive to GEN (95.8%), and F (86.7%), but resistant to AMP (58.3%) and SXT (79.2%). Klebsiella species were highly sensitive to GEN (100%). However, it was resistant to SXT (83.3%) and NA (100). Citrobacter species and Proteus species were also the most sensitive to GEN (100%) and F (100%), but 100% resistant to AMP, NA and SXT. In general Gram-negative isolates (n=33) showed resistance rate of 60% to AMP, 66.7% NA and 81.8% to SXT. Resistance against CRO, CIP, and NOR, was observed in the range of 15-40%. However, all Gram-negative bacterial isolates showed a low-level of resistance against F and MEM (6.1% and 9.1%) respectively while no resistance against GEN (Table 2).

Table 2: Antimicrobial susceptibility testing of Gram-negative pathogens from urine culture in pregnant women at Goba referral hospital, 2019

		Antimicrobial agents/no of bacterial isolates (%)									
Bacterial isolate	**Total no(%)**	**ASP**	**AMP**	**CRO**	**GEN**	**SXT**	**NOR**	**CIP**	**NA**	**MEM**	**F**
E.coli	24(42.9)	S	5(20.8)	10(41.7)	23(95.8)	3(12.5)	17(70.8)	13(54.2)	3(12.5)	17(70.8)	22(86.7)
		I	5(20.8)	7(29.2)	1(4.2)	2(8.3)	3(12.5)	4(16.7)	8(33.3)	6(25)	1(4.2)
		R	14(58.3)	7(29.2)	0(0)	19(79.2)	4(16.7)	7(29.2)	13(54.2)	1(4.1)	1(4.2)
Klebsiella spp.	6(10.7)	S	3(50)	1(16.7)	6(100)	1(16.7)	5(83.3)	5(83.3)	0(0)	4(66.7)	4(66.7)
		I	0(0)	2(33.3)	0(0)	0(0)	0(0)	0(0)	0(0)	1(16.7)	1(16.7)
		R	3(50)	3(50)	0(0)	5(83.3)	1(16.7)	1(16.7)	6(100)	1(16.7)	1(16.7)
Citrobacter spp	2(3.6)	S	0(0)	1(50)	2(100)	0(0)	0(0)	1(50)	0(0)	2(100)	2(100)
		I	0(0)	0(0)	0(0)	0(0)	2(100)	1(50)	0(0)	0(0)	0(0)
		R	2(100)	1(50)	0(0)	2(100)	0(0)	0(0)	2(100)	0(0)	0(0)
Proteus spp.	1(1.8)	S	0(0)	0(0)	1(100)	0(0)	0(0)	0(0)	0(0)	0(0)	1(100)
		I	0(0)	0(0)	0(0)	0(0)	1(100)	0(0)	0(0)	0(0)	0(0)
		R	1(100)	1(100)	0(0)	1(100)	0(0)	1(100)	1(100)	1(100)	0(0)
		S	8(24.2)	12(36.4)	30(90.9)	4(12.1)	22(66.7)	19(57.6)	3(9.1)	23(69.7)	29(87.8)
		I	5(15.2)	9(27.3)	3(9.1)	2(6.1)	6(18.2)	5(15.1)	8(24.2)	7(21.2)	2(6.1)
Total		R	20(60.6)	12(36.4)	0(0)	27(81.8)	5(15.1)	9(27.3)	22(66.7)	3(9.1)	2(6.1)

CIP= ciprofloxacin, NOR= norfloxacin, GEN= gentamicin, CRO= ceftriaxone, F= Nitrofurantoin AMP= ampicillin SXT= trimethoprim/sulfamethoxazole. NA= Nalidixic acid, MEM= meropenem, R = Resistant, S= Sensitive, I= Intermediate ASP= Antimicrobial susceptibility pattern.

Gram-Positive Bacteria

Gram-positive isolates were highly susceptible to GEN (95.7%), F (82.6%), clindamycin (69.6) and K (72.7%) while, resistant to SXT (95.7%). CoNS which were the predominant isolates among gram-positive were 100% resistance to SXT. Similarly, S. aureus also showed resistance to SXT (85.7) and F (57.1) but was sensitive to GEN (100%), F (71.4%), and K (71.4%). *Enterococcus* species were100% sensitive to NOR, CIP and F, but resistant to SXT (Table 3).

Table 3: Antimicrobial testing of Gram-positive bacteria isolated from urine culture of pregnant women at Goba referral hospital, 2019.

		Antimicrobial agents/no of bacterial isolates (%)							
		ASP	GEN	SXT	NOR	CIP	F	CD	K
S. aurues	7(12.5)	S	7(100)	1(14.3)	2(28.6)	3(42.9)	5(71.4)	5(71.4)	5(71.4)
		I	0(0)	0(0)	1(14.3)	2(28.6)	0(0)	1(16.7)	0(0)
		R	0(0)	6(85.7)	4(57.1)	2(28.6)	2(28.6)	1(16.7)	2(29.6)
CONS	15(26.8)	S	14(93.3)	0(0)	8(53.3)	6(40)	13(66.7)	11((73.3)	11(73.3)
		I	1(6.7)	0(0)	0(0)	1(6.7)	0(0)	1(7.1)	0(0)
		R	0(0)	15(100)	7(46.7)	8(53.3)	2(13.3)	3(21.4)	4(26.7)
Enterococcus spp.	1(1.8)	S	0(0)	0(0)	1(100)	1(100)	1(100)	0(0)	NA
		I	1(100)	0(0)	0(0)	0(0)	0(0)	1(100)	
		R	0(0)	1(100)	0(0)	0(0)	0(0)	0(0)	
		S	53(95.7)	1(4.3)	11(47.8)	10(43.5)	19(82.6)	16(69.6)	16(72.7)
Total		I	3(4.3)	0(0)	1(4.4)	3(13)	0(0)	3(13)	0(0)
		R	0(0)	22(95.7)	11(47.8)	10(43.5)	4(17.4)	4(17.4)	4(27.3)

CONS- Coagulase-negative Staphylococcus, CIP= ciprofloxacin, NOR= norfloxacin, GEN= gentamicin, F= Nitrofurantoin CD= Clindamcyin SXT= trimethoprim/sulfamethoxazole. K= Kanamycin, R = Resistant, S= Sensitive, I= Intermediate ASP= Antimicrobial susceptibility pattern

Multiple Drug Resistance Patterns of The Isolates

Multiple drug resistance (resistance to two or more antimicrobial drugs) was seen in all isolated pathogens (100%). All isolates of bacteria were resistant to at least two antimicrobials. No isolates were susceptible to all drugs tested (Tables 2 and 3).

Associated risk factors of UTI

The symptomatic and asymptomatic participants were almost equal in this study. Of the 234 women enrolled in study 54(23.1%) have had the previous history of UTI, 8(5.1%) history of a catheter, 15(6.4) history of catheterization and 136(58.1%) of the participants were used family planning previously (Table .2).

In bivariate logistic regression factors like the previous history of UTI, symptoms of UTI, history of a catheter, and history of gynecological surgery showed significant association ($p<0.05$). Multivariable logistic regression shown that the odds of acquiring UTI in pregnant women that had the previous history of UTI 4.42 times higher than those had no previous history(AOR= 4.42; 95%CL, 2.12-9.20, P=0.00). Similarly, the risk of UTI infection was 5.75 times higher in those who have had the previous history of catheterization (Table .4).

Table 4: Associated factors of UTI among pregnant women attended MWU GRH ANC, 2019

Characteristic	Cultured No. (%)	Significant Bacteriuria No.(%)	COR(95% CL)	AOR(95% CL)	P-value
History of UTI					
Yes	54(23.1)	27(50)	5.2(2.68-10.13)*	4.42(2.12-9.20)*	0.00
No	180(76.9)	29(16.1)	1	1	
Symptom of UTI					
Yes	115(49.1)	37(32.2)	2.49(1.33-4.68)*	0.49(0.24-1.01)	0.64
No	119(50.9)	19(16)	1	1	
Fever					
Yes	26(11.1)	10(38.5)	2.20(0.94-5.18)	0.89(0.30-2.47)	0.79
No	208(88.9)	46(22.1)	1	1	
History of gynecological surgery					
Yes	12(5.1)	8(66.7)	7.25(2.09-25.1)*	0.49(0.10-2.29)	0.37
No	222(94.9)	48(21.6)	1	1	
History of kidney problem					
Yes	18(7.7)	6(33.3)	1.66(0.59-4.65)	1.15(0.35-3.82)	0.81
No	216(92.3)	50(23.1)	1	1	
History of catheterization					
Yes	15(6.4)	10(66.7)	7.52(2.45-23.1)*	5.75(1.46-22.7)*	0.012
No	219(93.6)	46(21)	1	1	
History of contraceptive					
Yes	136(58.1)	35(25.7)	1.27(0.68-2.36)	0.99(0.49-2.01)	0.99
No	98(41.9)	21(21.4)	1	1	
History of diabetes Mellitus					
Yes	5(2.1)	0(0.0)			
No	229(97.9)	56(24.5)	0	0	

NB: COR; Crude Odd Ratio AOR; Adjusted Odd Ratio

* = statistically significant (p-value < 0.05), COR (95%CI) = crudes odds ratio at 95% confidence interval, AOR (95%CI) = adjusted odds ratio at 95% confidence interval

Discussion

The current study has shown that 23.9% of pregnant women had UTIs in the course of their pregnancy. The overall prevalence of UTI in pregnant women in the current study is comparable to the prevalence of UTI described in Buea health district, Cameroon (23.5%), Muhimbil National Hospital, Tanzania (21%), Nairobi, Kenya (26.7%), Hawassa, Southern Ethiopia (18.8%) and Ambo (18.7%), but relatively higher than the reports from Khartoum, Sudan (14%), Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia (11.6%), University of Gondar Teaching Hospital, Northwest Ethiopia (10.4%), Jimma Specialized Hospital, Southwest Ethiopia (9.2%), and Dil Chora Referral Hospital, Dire Dawa, Eastern Ethiopia (14%) [3, 6-9, 11, 17, 19-22]. In contrast, this finding was lower than the study performed in Hodeida City, Yemen (54.5%) and Ghana (29.9%) [23, 24]. This difference may be enlightened by the changes in the environmental conditions, a method implemented & features of study populations such as societal and food habits and the standard of personal hygiene [25].

In this study, Gram-negative bacteria isolates were more predominant (58.9%) than Gram-positive bacteria isolates (41.1%). Similar results were reported in previous Ethiopian studies with (60% vs. 40 %) reported in Tikur Anbessa Specialized Hospital Addis Ababa and (58.4% vs. 41.6%) in Gondar University Hospital and elsewhere in the world [8, 19, 11, 21]. The high percentage of isolation of Gram-negative uro-pathogens might be due to the existence of distinctive structure in Gram-negative bacteria which support for adhesion to the uro-epithelial cells and inhibit bacteria from urinary lavage, permitting for reproduction and tissue invasion [26]. E. coli was the most frequent etiological agent of UTI, which accounts for up to 42.9% of isolated bacteria. The current result is in agreement with the finding from Ethiopia [8, 3, 21]. It is also

consistent with findings from Kenya and Cameroon [9, 11]. E. coli was considered as the most dominant uro-pathogenic bacteria due to several virulence factors specific to colonization and invasion of the urinary epithelium [26]. The second common bacterial isolate was Coagulase-negative staphylococci (CoNS) and S. aureus, with an overall isolation rate of 26.8% and 12.5% respectively. A comparable result was reported in other studies conducted elsewhere [13, 8, 27]. *Klebsiella* species, *Proteus* species, *Citrobacter* species and *Enterococcu*s species were also causative agents of UTI.

The prevalence of bacteriuria among symptomatic and asymptomatic pregnant women was 32.2% and 16% respectively. This result is higher than the studies conducted in Dil Chora, Ethiopia, and Sudan [6, 17]. This is due to the study site is far from the center and the health care system is weak.

The prevalence of UTI in pregnant women with a former history of UTI was statistically significant ($p = 0.00$). This finding is comparable with earlier studies conducted in Ethiopia [6, 8] and elsewhere in Saudi Arabia [28]. This could be due to ineffective treatment or the occurrence of resistant strains from those who had a prior history of UTI. The prevalence of UTI in pregnant women with the previous history of catheterization was also significantly greater than those without a history of previous catheterization ($p = 0.012$). Similar findings were reported in Ethiopia [8, 27]. But, other associated factors of bacteriuria in pregnancy like age, residence, marital status, occupation, level of education, socioeconomic status, gestational stage, history of gynecological surgery, kidney problem and gravidity were not showed a significant association. This is in agreement with numerous studies in Ethiopia [8, 13, 27] and Sudan [17].

This finding showed a higher percentage of resistance to regularly prescribed antimicrobial drugs. Most isolates of Gram-negative bacteria showed resistance to AMP, SXT and NA. However, Gram-negative isolates were showed high sensitivity to GEN and F. This is agreeing with the research conducted in Addis Ababa Ethiopia [21]. *E. coli* isolates were showed high resistance to AMP and SXT. The current result is marginally related to the finding from Dire Dawa and Ambo [3, 6]. A high level of resistance of *Klebsiella* species to AMP and NA were revealed in the study area. *Citrobacter* species and *Proteus* species were showed high resistance against AMP, SXT and NA.

Among Gram-positive bacteria tested, more than 70% of the isolates were sensitive to GEN, F, CLD, and K. *S. aureus* showed resistance to SXT and NOR, while CoNS showed resistance to SXT. *Enterococcus* species were resistant to SXT but sensitive to NOR, CIP and F.

All bacteriological isolates of the present research exhibited resistance to at least two antimicrobials and no isolate was sensitive to all antibiotics tested. This correlates with the study done in Gondar university teaching hospital [8]. However, this result is higher than the report from Tikur Anbesa specialized hospital [21]. A high prevalence of MDR reported in this study might be due to the unhindered accessibility and high rate of use of non-prescribed drugs. It might also be associated with the quick spread of resilient bacteria and a high frequency of mismanagement of antimicrobials such as self-prescription, excessive use, failure to follow the standard treatment guidelines and scarce or absence of antimicrobial drug resistance surveillance program [14, 29].

Limitations

The limitation of this cross-sectional hospital-based study is that an equal number of study subjects from urban and rural parts were not included and hence this might limit interpretation of the finding to the general population of the area.

Conclusion and Recommendations

This study showed an overall high prevalence of UTI in pregnant women. E. coli were the most leading bacterial isolates followed by CoNS and S. aureus. An increasing percentage of resistance to the usually used antimicrobial agents has been observed for both Gram-negative and Gram-positive isolates and multi-drug resistance has been shown in 100% of bacterial isolates. GEN and F might be considered as alternative options in the management of UTIs. This study recommends that the early detection of the causative agents of UTI and determining their antimicrobial sensitivity testing in pregnant women will help to confirm suitable management of UTI and to inhibit its additional problem in mother and fetus. Health education about the causes of UTI and drug use should be given to pregnant women. A more comprehensive survey should be carried out, to isolate other causes of UTI.

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References

1. Rahimkhani M, Khavari-Daneshvar H, Sharifian R (2008) Asymptomatic bacteriuria and pyuria in pregnancy. Acta Medica Iranica. 409-412.
2. IO Okonko, LA Ijandipe, OA Ilusanya, OB Donbraye-Emmanuel, J Ejembi, et al. (2009) Incidence of urinary tract infection (UTI) among pregnant women in Ibadan, South-Western Nigeria. African Journal Biotechnology.
3. Yonas Alem Gessese, Dereje Leta Damessa, Mebratenesh Mengistu Amare, Yonas Hailesilassie Bahta, Assalif Demisew Shifera, et al (2017) Urinary pathogenic bacterial profile, antibiogram of isolates and associated risk factors among pregnant women in Ambo town, Central Ethiopia: a cross-sectional study. Antimicrobial Resistance and Infection Control 6: 132.
4. Gulfareen Haider, Nishat Zehra, Aftab Afroze Munir, Ambreen Haider (2010) Risk factors of urinary tract infection in pregnancy. JPMA. Journal of Pakistan Medical Association 60: 213.
5. Mohamed Ghaith Al-Kuwari, M Taher Aseel, F Mohamed Al-Meer, M F Ismail (2009) Prevalence and Predictors of Asymptomatic Bacteriuria among Pregnant Women Attending Primary Health Care in Qatar. Middle East Journal Family

Medicine 7: 10-13.
6. Behailu Derese, Haji Kedir, Zelalem Teklemariam, Fitsum Weldegebreal, Senthilkumar Balakrishnan (2016) Bacterial profile of urinary tract infection and antimicrobial susceptibility pattern among pregnant women attending at Antenatal Clinic in Dil Chora Referral Hospital, Dire Dawa, Eastern Ethiopia. Therapeutic clinical risk management 12: 251.
7. Andargachew Mulu, Feleke Moges, Belay Tessema, Afework Kassu (2006) Pattern and multiple drug resistance of bacterial pathogens isolated from wound infection at University of Gondar Teaching Hospital, Northwest Ethiopia. Ethiopian medical journal 44: 125-131.
8. Agersew Alemu, Feleke Moges, Yitayal Shiferaw, Ketema Tafess, Afework Kassu, et al. (2012) Bacterial profile and drug susceptibility pattern of urinary tract infection in pregnant women at the University of Gondar Teaching Hospital, Northwest Ethiopia. BMC research notes 5: 197.
9. Morike Ngoe Mokube, Julius Atashili, Gregory Edie Halle-Ekane, George M Ikomey, Peter M Ndumbe (2013) Bacteriuria amongst pregnant women in the Buea Health District, Cameroon: Prevalence, predictors, antibiotic susceptibility patterns and diagnosis. PloS one.
10. Ade Ojo IP, Oluyege AO, Adegun PT, Akintayo AA, Aduloju OP, et al. (2013) Prevalence and antimicrobial susceptibility of asymptomatic significant bacteriuria among new antenatal enrollees in Southwest Nigeria. International Resistance Journal of Microbiology 4: 197-203.
11. Willy Fred Nabbugodi, J Wanyoike Gichuhi, N W Mugo (2015) Prevalence of Urinary Tract Infection, Microbial Aetiology, and Antibiotic Sensitivity Pattern among Antenatal Women Presenting with Lower Abdominal Pains at Kenyatta National Hospital, Nairobi, Kenya. Open Access Journal of Science and Technology 3: 1-6.
12. Matuszkiewicz-Rowińska J, Małyszko J, Wieliczko M (2015) Urinary tract infections in pregnancy: old and new unresolved diagnostic and therapeutic problems. Archives of medical science: AMS 11: 67.
13. Tazebew E, Beyene G, Tsegaye W, Melaku S (2013) Associated risk factors of urinary tract infection among pregnant women at Felege Hiwot Referral Hospital, Bahir Dar, North West Ethiopia. BMC research notes 6: 292.
14. Cheesbrough M (2006) Medical Laboratory Manual for Tropical Countries 2: 255- 275.
15. Negash Hadera Gebrekirstos, Birhanu Demeke Workneh, Yosef Sibhatu Gebregiorgis, Kebede Haile Misgina, Negassie Berhe Weldehaweria, et al. (2017) Non-prescribed antimicrobial use and associated factors among customers in drug retail outlet in the central zone of Tigray, northern Ethiopia: a cross-sectional study. Antimicrobial Resistance and Infection Control 6: 70.
16. Courvalin P, Trieu Cuot P (2001) Minimizing potential resistance: the molecular view. Clinical infectious diseases 33: 138-146.
17. Hamdan Z Hamdan, Abdel Haliem M Ziad, Salah K Ali, Ishag Adam (2011) Epidemiology of urinary tract infections and antibiotics sensitivity among pregnant women at Khartoum North Hospital. Annals of clinical microbiology and antimicrobials 10: 2.
18. Bauer AW (1966) Antibiotic susceptibility testing by a standardized single disc method. American Journal of clinical pathology 45: 149-58.
19. Sabrina J Moyo, Said Aboud, Mabula Kasubi, Samuel Y Maselle (2010) Bacterial isolates and drug susceptibility patterns of urinary tract infection among pregnant women at Muhimbili National Hospital in Tanzania. Tanzania Journal of Health Research 12: 233-236.
20. Endale Tadesse, Million Teshome, Yared Merid, Belayhun Kibret, Techalew Shimelis (2014) Asymptomatic urinary tract infection among pregnant women attending the antenatal clinic of Hawassa Referral Hospital, Southern Ethiopia. BMC research notes 7: 155.
21. Agersew Alemu, Feleke Moges, Yitayal Shiferaw, Ketema Tafess, Afework Kassu, et al. (2008) Bacterial profile and drug susceptibility pattern of urinary tract infection in pregnant women at Tikur Anbessa Specialized Hospital Addis Ababa, Ethiopia. Ethiopian medical journal 46: 227-235.
22. Beyene G, Tsegaye W (2011) Bacterial uropathogens in urinary tract infection and antibiotic susceptibility pattern in Jimma University specialized hospital, southwest Ethiopia. Ethiopian journal of health science 21: 141-146.
23. AL Kadassy AM, Baraheem OH, Ogaili MA (2016) The Prevalence of Urinary Tract Infection (UTI) Among Pregnant Women In Hodeidah City. IOSR Journal Dental Medical Science (IOSR-JDMS) 15: 105-109
24. Daniel Kwame Afriyie, Martha Gyansa-Lutterodt, Seth Kwabena Amponsah, George Asare, Vanessa Wiredu, et al. (2015) Susceptibility pattern of uropathogens to ciprofloxacin at the Ghana police hospital. Pan African Medical Journal 22: 87.
25. Iram Shaifali, Uma Gupta, Syed Esam Mahmood, Jawed Ahmed (2012) Antibiotic susceptibility patterns of urinary pathogens in female outpatients. North American Journal of medical science 4: 163.
26. Jean Philippe Lavigne, Adeline Boutet Dubois, Dorsaf Laouini, Christophe Combescure, Nicole Bouziges, et al. (2011) Virulence potential of Escherichia coli strains causing asymptomatic bacteriuria during pregnancy. Journal of clinical microbiology 49: 3950-3953.
27. Getachew Ferede, Gizachew Yismaw, Yitayih Wondimeneh, Zufan Sisay (2012) The prevalence and antimicrobial susceptibility pattern of bacterial uropathogens isolated from pregnant women. European Journal of Experimental Biology 2: 1497-1502.
28. Al Sibai MH, Saha A, Rasheed P (1989) Socio-biological correlate of bacteruria in Saudi pregnant women. Public health 103: 113-121.
29. DACA (2009) Antimicrobials use, resistance and containment baseline survey syntheses of findings, Addis Ababa, Ethiopia.