Asymptomatic Bacteriuria among Pregnant women in Addis Ababa, Ethiopia: Prevalence, Causal agents, and their Antimicrobial Susceptibility

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Research

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Abstract

Background

Asymptomatic bacteriuria (ASBU) is an important health problem among pregnant women particularly in low income countries. This study aimed to estimate prevalence of ASBU, to identify causal bacterial pathogens and their antimicrobial susceptibility among pregnant women attending antenatal care centers in Addis Ababa, Ethiopia.

Methods

Health facility based cross-sectional study was conducted from March to May, 2019, where 281 pregnant women with no symptom of urinary tract infection were examined using standard microbiological techniques. Women whose urine sample carried greater than or equal to 10^5 colony forming unit (CFU) of bacteria per milliliter was considered to have ASBU. Antimicrobial susceptibility of isolates was investigated using Kirby-Bauer disk diffusion method on Muller-Hinton agar plates.

Results

Out of 281 pregnant women examined, 44 (15.7%) had ASBU and none of the factors tested in the current analysis were significantly associated with occurrence of ASBU ($p < 0.05$). The most frequently isolated bacterial species were *Escherichia coli* 17(30.2%), *Proteus*, 13(23.2%) and *Enterococcus* 11(19.6%). All of the *E. coli*, *Citrobacter* and *Klebsiella* isolates and 84.6% of *Proteus* species were resistant to ampicillin. All bacterial isolates were resistant to at least one of antimicrobial agents tested. Resistance to three or more antimicrobials was detected in 15 (88.2%) of *E. coli*, 10 (76.9%) of *Proteus*, and 6 (54.6%) of *Enterococcus* isolates. Resistance to as high as 7 antimicrobials among *E. coli* and *Proteus* isolates and 9 antimicrobials among *Enterococcus* isolates was detected.

Conclusions

Routine screening for ASBU during antenatal visit is likely to result in early treatment and minimize complication to the mother and fetus. Assess sensitivity of isolates to commonly prescribed antimicrobials rather than treating empirically is recommended.

Background

Asymptomatic bacteriuria (ASBU) is defined as existence of bacteria in urine at a load of 10^5 CFU/ml or more in the absence of clinical symptoms of urinary tract infection [1, 2]. Although both gender and all age groups are prone to ASBU, it is more common in women due to proximity of female urethra to anus which facilitates colonization of the periurethral area with bacteria from gastrointestinal tract [3, 4]. Its occurrence in women increases directly with sexual activity and in women of child-bearing age [4, 5]. Diabetic patients, women with low level of educational status and those with history of urinary tract infection are reported to be at higher risk of developing ASBU[6]. Pregnant women are particularly prone to urinary tract infection and ASBU due to physiologic changes associated with pregnancy like smooth muscle relaxation, dilation of the ureters and renal pelvis which favor bacterial multiplication [7]. In addition, a general decline in immunity during pregnancy predisposes women to infection [8].

Pregnant women with ASBU suffer from various adverse outcomes. For instance, 50% of pregnant women with ASBU were reported to develop symptomatic urinary tract infection manifested by pyelonephritis followed by high rate of intrauterine growth restriction leading to low birth-weight infants, increased risk of preterm labor, pregnancy-induced hypertension, preeclampsia, amnionitis and anemia[9, 10]. Systematic review and meta-analysis showed strong association of ASBU with both type 1 and type 2 diabetes[11]. A prospective observational study among women with diabetes and ASBU also reported increased risk of hospitalization for urosepsis [12].

Prevalence of ASBU among pregnant women varies across different countries and it is more common in developing countries. In Africa, prevalence of 24.7% was reported from Nigeria[13], whereas in Ghana, prevalence of 5.5% was reported [14]. Prevalence of 21.2% and 18.8% was reported from North and South Ethiopia [15, 16]. The common bacteria isolated from pregnant women with ASBU, include *Escherichia coli*, *Klebsiella species*, *Enterococcus faecalis*, *Proteus species*, and *Staphylococcus aureus* [17–19]. Potential complications associated with ASBU are significantly decreased in pregnant women if treated with appropriate antimicrobials [20]. However, reports elsewhere show that pathogenic bacteria including uropathogens are developing resistance to antimicrobials, and multi-drug resistant strains are emerging rapidly posing major threat [21]. Understanding the rate of occurrence of ASBU among pregnant women, factors associated with its occurrence, identification of bacterial pathogens involved and their antimicrobial susceptibility is vital in advising clinicians on appropriate management of urinary tract infection and associated complications. Therefore, this study aimed to assess the occurrence of ASBU, factors associated with risk of ASBU, bacterial pathogens involved and their antimicrobial susceptibility among pregnant women attending antenatal care services in Addis Ababa, Ethiopia.

Materials And Methods

Study area and study design

This study was conducted in Addis Ababa, the capital city of Ethiopia from March to May, 2019. Health facility based cross-sectional study design was employed to recruit pregnant women by simple random sampling method from antenatal care centers of two government hospitals namely: Tikur Anbessa Specialized Hospital (TASH) and Zewditu Memorial Hospital (ZMH) and two private health care facilities: Ananiya, and Hemon mother and child health care specialty centers located in Addis Ababa.

Sample size determination and recruitment of study participants

The sample size was calculated using single population proportion formula based on the previous report of 21.2% of ASBU in the northern Ethiopia [22]. With 95% confidence interval, 10% non-response rate and 5% marginal error, the calculated sample size was 283.

First, total sample size calculated was allocated into the study hospitals proportional to the number of pregnant women attending selected antenatal care centers. Once clear explanation about the study was given to each pregnant women coming to antenatal care center for routine antenatal care service, they were requested to be involved in the study. Pregnant women excluded from the study were those <18 years of age, those with symptomatic urinary tract infection, who took two or more glasses of fluid one hour before clinic attendance, who were treated with antimicrobials during the last one week and women with current symptoms of sexually transmitted infections. Among those who volunteered to participate and fulfill the inclusion criteria, half of them were recruited randomly. Two rolled paper coded as number one, and zero were offered to participants to pick one and those who picked a rolled paper labeled with number one were recruited.

Data and sample collection

Information about age, residence, religion, marital status, educational status, monthly income, frequency of sexual intercourse per week, frequency of vaginal douching per day, history of urinary tract infection in this pregnancy; past history for chronic diseases (diabetes mellitus, hypertension), history of sexually transmitted diseases, stage of pregnancy and parity were collected from each woman through interview during sample collection. Current status of the pregnant women for HIV/AIDS and Hepatitis B surface antigen was reviewed from the recent information sheets of pregnant women's chart. After instructing the women to take perineal care, a clean-catch midstream urine samples were collected into sterile containers and transported to Microbiology Laboratory of Aklilu lemma Institute of Pathobiology in ice box within 3-4 hours of collection.

Urine sample processing and pathogen isolation

A loopful (10 micro liter) of well mixed urine sample was inoculated on to plate count agar and grown for 24h at 37°C. Number of colonies grown on each plate was counted to determine colony forming units per milliliter (CFU/ml) of the urine sample. A urine sample containing $\geq 10^5$ cfu/ml was considered as having ASBU [9]. For determination of the type of organisms involved, colonies from plate count agar plates were picked and inoculated to various selective media such as Eosine Methylene Blue (EMB) agar to differentiate *Escherchia coli*, *Klebsiella species*, and *Citrobacter species*; Cystiene-lactose-electrolyte-deficient (CLED) medium to differentiate *proteus species*; biosculine agar and enterococcus agar to identify *Enterococcus species* after incubating for 24 hrs at 37°C. In addition, urine samples from women with ASBU were also directly plated to selective media. Further, biochemical tests like triple sugar iron agar, lysine iron agar, citrate, urease, indole, potassium hydroxide (KOH), and catalase tests were employed to further identify type of bacterial species involved[23-25].

Investigation of antimicrobial susceptibility of bacterial isolates

The antimicrobial susceptibility tests of the isolates were performed according to the Clinical Laboratory Standards Institute (CLSI) guideline[26] using Kirby-Bauer disk diffusion method on Muller-Hinton agar plates (Oxoid, CM0337 Basingstoke, England). The following antimicrobial (Sensi-Discs, Becton, Dickinson and Company, Loveton, USA) and disc potencies were used: amoxicillin + clavulanic acid (Amc) (20/10 µg), ampicillin (Amp) (10 µg), cephalothin (CF) (30 µg), ceftriaxone (Cro) (30 µg), ciprofloxacin (Cip) (5 µg), gentamicin(Gm) (10 µg), streptomycin(S) (10 µg), sulfisoxazole (G), sulfamethoxazole+ trimethoprim (Sxt) (23.75/1.25 µg), tetracycline (Te) (30 µg), chloramphenicol (C), (30 µg), vancomycin (Va) (30 µg), kanamycin (K), (30 µg) erthromycin (Ery) (15 µg), Oxacillin, (ox), (1µg), clindamycin (DA) (2 µg), penicillin (P) (10 µg). *Escherichia coli* ATCC 25922 and *Staphylococcus aureus* ATCC25923 were used as a quality control organisms for gram negative and gram positive organisms, respectively. The interpretation of the categories of susceptible and resistant was based on the CLSI guidelines [26]. Isolates were regarded as multi-drug resistant (MDR) when they were resistant to at least two or more antimicrobials belonging to different classes [27].

Data analysis

Descriptive statistics: mean, standard deviation, frequency and percentage were used to summarize different variables. Logistic regression was used to model association of pre-defined independent variables with the binary outcome. P-value less than 0.05 was as indicator for statistical significance.

Results

Prevalence of asymptomatic bacteriuria

Out of 281 cultured urine samples, 44 had greater than or equal to 10^5 cfu/ml, resulting in 15.7% prevalence of ASBU with no significant difference between private health care institutions (n=14;18.0%) and government hospitals (n=30;14.8%). Forty-one (16.6%) married and 3(8.8%) unmarried pregnant women were positive for ASBU. Similarly, lower monthly income and being illiterate were associated with minor non-significant increase in occurrence of ASBU (Table 1).

Table 1
Association of demographic characteristic with ASBU, N=281

Variables	No. tested	+ve for ASBU	COR(95%CI)	AOR(95%CI)	p - Value
Type of health facility		No. (%)			0.34
Private	78	14(18)	1.03(0.50, 2.12)	0.62(0.23, 1.66)	
Government	203	30(14.8)	**		
Age					0.23
18-24	74	9(12.2)	1.41(0.46, 4.00)	2.31(0.63, 8.50)	
25-34	166	28(16.9)	0.78(0.30, 2.01)		
35-49	41	7(17.1)	**		
Residence					0.19
AA	236	38(16.1)	0.80(0.32, 2.03)	0.48(0.17, 1.42)	
OAA	45	6(13.3)	**		
Religion					0.88
Christian	211	34(16.1)	1.32(0.65, 2.70)	1.07(0.44, 2.63)	
Muslim	70	10(14.3)	**		
Marital status					0.35
Married	247	41(16.6)	0.49(0.14, 1.67)	0.52(0.13, 2.05)	
Unmarried	34	3(8.8)	**		
Educational status					0.64
Illiterate	39	9(23.1)	0.49(0.19, 1.25)	0.57(0.14, 2.25)	
Grade 1-12	133	20(15)	0.79(0.38, 1.63)		
≥ College	109	15(13.8)	**		
Income per month(EB)					0.73
≤ 2000	101	19(18.8)	0.70(0.36, 1.34)	0.87(0.39, 1.92)	
>2000	180	25(13.9)	**	**	

ETB = Ethiopian birr, AA = Addis Ababa, OAA = out of Addis Ababa, COR = Crude Odds ratio, AOR = Adjusted odds ratio, CI = confidence interval, ** = reference

Association of selected factors with the occurrence of ASBU

Being younger age group OR = 2.31(95%CI: 0.63, 8.50), less frequency of vaginal douching per day OR = 1.83(95%CI: 0.82, 4.07), history of previous urinary tract infection in this pregnancy OR = 1.23(95%CI: 0.59, 2.58) were slightly more likely to be associated with the ASBU. However, none of the variables tested for association were statistically significant at $p < 0.05$ (Table 3). Similarly, frequency of vaginal douching, frequency of sexual contact, history of chronic diseases, stage of pregnancy and other factors did not show statistically significant association with occurrence of ASBU (Table 2).

Table 2
Association of background and clinical characteristics with ASBU, N=281

Variables	Tested No.	poitive for ASBU No. (%)	COR(95%CI)	AOR(95%CI)	P - Value
Frequency Vaginal douching per day					0.14
≤ Two times	117	14(12)	1.65(0.83, 3.27)	1.83(0.82,4.07)	
≥ Three times	164	30(18.3)	**		
History of chronic disease					0.70
Yes	52	10(19.2)	0.86(0.39, 1.96)	0.84(0.34, 2.07)	
No	229	34(14.8)	**		
Parity					0.78
Primi para	183	27(14.8)	1.21(0.63, 2.36)	1.14(0.45, 2.88)	
Multi para	98	17(17.3)	**		
Stage of pregnancy					0.83
First trimester	103	19(18.4)	0.77(0.35, 1.66)	0.90(0.35, 2.34)	
Second trimester	90	12(13.3)	1.13(0.48, 2.63)		
Third trimester	88	13(14.8)	**		
Serology test status					0.15
+Ve for HIV/AIDS	13	3(23.1)	0.61(0.16, 2.30)	0.33(0.75, 1.48)	
+ Ve for HiBsAg	14	2(14.3)	1.09(0.23, 5.05)		
-Ve for both	254	39(15.4)	**		
VDRL test status					0.27
Positive	18	2(11.1)	3.32(0.43, 25.63)	3.00(0.39, 27.77)	
Negative	236	42(17.8)	**		
History of treatment for UTI in this pregnancy					0.36
Yes	89	13(14.6)	1.23(0.59, 2.58)	1.51(0.62, 3.67)	
No	192	31(16.1)	**	**	
Note: History chronic disease includes: Diabetes mellitus (DM), hypertension (HPT), and renal calculi (RC).					
HIV/AIDS: Human immune-deficiency virus/acquired immunodeficiency syndrome, HiBsAg: hepatitis B surface antigen, ANC: Antenatal care, No. = Number, ** = Reference.					

Common bacterial pathogens isolated from pregnant women with ASBU

A total of 56 bacterial pathogens were isolated from 44 pregnant women with ASBU of which 45(80.4%) were gram negative, while the remaining 11 were gram positive organisms. The isolated bacterial species were *E. coli*: 17 (30.6%) followed by *Proteus* spp., 13(23.2%), *Enterococcus* spp., 11(19.6%), *Klebsiella* spp., 8 (14.3%) and *Citrobacter* spp., 7 (12.3%). Among the 44 participants that were positive for ASBU, 15(34.1%) were positive for more than one bacterial pathogens. The most frequent bacterial species that appeared jointly in single pregnant women's urine sample were *E. coli*, and *Proteus*.

Antimicrobial susceptibility of bacterial isolates

All of the *E. coli*, *Citrobacter* and *Klebsiella* isolates and 84.6% of *Proteus* were resistant to ampicillin. Similarly, 70.6% of *E. coli*, 100% of *Citrobacter* and *Klebsiella* isolates and 84.6% of *Proteus* species were resistant to cephalothin. High rate of resistance to other antimicrobials such as amoxicillin+clavulanic acid and sulfisoxazole was also recorded. Resistance to ceftriaxone was detected in 17.6%, 28.6%, 37.5%, and 38.4% of *E. coli*, *Citrobacter*, *Klebsiella* and *Proteus* isolates respectively. All of the *Enterococcus* isolates were resistant to SXT, whereas 90.9% and 72.7% of the isolates

were resistant to chloramphenicol and amikacin, respectively. Relatively low level of resistance to ciprofloxacin was observed in all species of bacteria isolated in the current study (Table 3).

Table 3
Antimicrobial susceptibility test result of bacteria isolated from pregnant women with ASBU(N=56)

Bacterial isolates	Antimicrobials tested No. and (%) resistant											
	TE	SXT	S	GM	AM	CRO	CIP	CF	C	AN	AMC	G
<i>E. coli</i> (N=17)	3(17.6)	1(5.9)	4(23.5)	2(11.8)	17(100)	3(17.6)	1(5.9)	12(70.6)	1(5.9)	1(5.9)	13(76.4)	9(53)
<i>Citrobacter</i> spp. (N=7)	1(14.3)	1(14.3)	4(57.1)	0(0.0)	7(100)	2(28.6)	0(0.0)	7(100)	0(0.0)	3(42.9)	6(85.7)	6(85.7)
<i>Klebsiella</i> spp. (N=8)	0(0.0)	2(25)	2(25)	1(12.5)	8(100)	3(37.5)	1(12.5)	8(100)	1(12.5)	1(12.5)	8(100)	3(37.5)
<i>Proteus</i> spp. (N= 13)	3(23.1)	1(7.7)	3(23.1)	1(7.7)	11(84.6)	5(38.4)	0(0.0)	11(84.6)	2(15.4)	2(15.4)	12(92.3)	4(30.8)
<i>Enterococcus</i> spp. (N=11)	VA	P	ERY	CIP	C	CRO	K	CF	OX	DA	AMC	GM
	3(27.3)	11(100)	3(27.3)	2(18.2)	3(27.3)	2(18.2)	1(9.1)	6(54.5)	10(90.9)	8(72.7)	6(54.5)	0(0.0)

TE = Tetracycline, SXT = Sulphamethoxazole +Trimethoprim, S = Streptomycin, GM = Gentamycine, G = Sulfisoxazole, CRO = Ceftriaxone, CIP = Ciprofloxacin, CF = Cephalothin, C = Chloramphenicol, AN = Amikacin, AMC = Amoxicillin + Clavulanic Acid, AM = Ampicillin, Va = Vancomycin, P = Penicillin, ERY = Erthromycin, K = kanamycin, OX = Oxacillin, DA = Clindamycin, , G = Sulfisoxazole.

Resistance to 3 or more antimicrobials was detected in 15 (88.2%), 10 (76.9%), and 6 (54.6%) of *E. coli*, *Proteus* and *Enterococcus* isolates, respectively. The common resistance pattern detected among *E. coli* isolates was resistance to G, CF, AM, AMC in 6 (35.6%) of the 17 isolates. Two *E. coli* isolates in the current study were resistant to 7 antimicrobials tested. Five (38.5%) of *Proteus* isolates and one (12.5%) of *Klebsiella* isolate were resistant to seven antimicrobials. Out of the eleven *Enterococcus* species isolated; eight (72.7%) of them were resistant to two or more antimicrobials tested. One of the *Enterococcus* isolated from the pregnant women attending private antenatal care center was resistant to 9 antimicrobials (Table 4).

Table 4
Antimicrobial resistance pattern of bacterial pathogens, N = 56

Bacterial species	Health facility	Resistance pattern	NRP	TNatbR
<i>E. coli</i> (17)				
	TASH(06)	TE, S, GM, CRO	1	4
		G, CF, AMC, AM	5	4
	ZMH(09)	CIP, TE, SXT, GM, CRO	1	5
		S	2	1
		G, CF, AM, AMC	6	4
	Private(02)	CRO, G, TE, S, CF, AMC, AM	2	7
<i>Proteus Spp</i> (13)				
	TASH(04)	TE, SXT, S, GM, G, CRO, AN	1	7
		CF, AMC, AM	3	3
	ZMH(08)	CRO, AN, C, TE, AM, AMC, CF	5	7
		S, G	3	2
	Private(01)	CRO, CF, AM, AMC	1	4
<i>Enterococcus Spp</i> (11)				
	TASH(02)	P, OX, DA, CRO, CF, AMC	2	6
	ZMH(05)	P, DA, C, VA, AMC, CF,	3	6
		OX, P	2	2
	Private(04)	P, OX, DA, CF, AMC, VA, ERY, CRO, CIP	1	9
		P	3	1
<i>Klebsiela Spp</i> (8)				
	TASH(04)	S, G, TE, SXT, GM, CIP, AN	1	7
		CF, AMC, CRO	3	3
	ZMH(03)	SXT, G, CRO, C, CF, AMC	3	6
	Private(01)	CF, AMC	1	3
<i>Citrobacter Spp</i> (7)				
	TASH(02)	G, CF, AN, AM, AMC	2	6
	ZMH(04)	S, CRO, CF, AM, AMC	1	5
		G	3	1
	Private(1)	S, G, CRO, CF, AN, AMC	1	6

NRP = Number with resistance pattern, TNatbR = Total number of antimicrobial to which isolate is resistant, TE = Tetracycline, SXT = Sulphamethoxazole+Trimethoprim, S = Streptomycin, GM = Gentamicin, CRO = Ceftriaxone, CIP = Ciprofloxacin, CF = Cephalothin, C = Chloramphenicol, AN = Amikacin, AMC = Amoxacillin + Clavulanic Acid, AM = Ampicillin, VA = Vancomycin, P = Penicillin, ERY = Erythromycin, OX = Oxacillin, DA = Clindamycin, G = Sulfisoxazole, AN = Amikacin, TASH = Tikur Anbesa Specialized Hospital, ZMH = Zewditu Memorial Hospital

Discussion

Presence of high load of bacteria in the urine of pregnant women, is reported to lead to complications like pyelonephritis, septicemia and, may also result in low birth weight and still birth [10]. The current study showed that the prevalence of ASBU among pregnant women attending antenatal care services in Addis Ababa was 15.7% which is lower than the prevalence reported from Northern Ethiopia (21.2%) [28], south Ethiopia (18.8%)[15] and Nigeria (24.7%) [13]. It is however higher than the prevalence reported from Ghana (5.5%) [14] and North West Ethiopia 9.8% [29]. The possible reason for such difference could be due to variation in care during urine collection, difference in socioeconomic status, and genital hygienic practices among pregnant women from different background[30, 31].

Although previous reports showed that increased maternal age, multi-parity[30, 32], sexual activity[14], past history of urinary tract infection[33] are associated with occurrence of ASBU among pregnant women, our data did not replicate the association. This may be attributed partly to small sample.

The most frequently isolated bacterial uropathogens in this study is *E. coli* 17(30.6%), which is in agreement with previous studies elsewhere [16, 33, 34]. However, it is contrary to the study from India, which reported *Staphylococcus aureus* as the most prevalent pathogen[35]. None of the pregnant women with ASBU in the current study were positive for *S. aureus* unlike most of the previous studies [16, 34]. Previous studies also showed that *S. aureus* bacteriuria is unusual except in patients with predisposing conditions for ascending colonization such as history of urinary obstruction, urinary catheter, recent urological surgical procedures, malignancy and recent hospitalization [36–38].

Proteus spp., 13(23.2%) is the second most frequently isolated bacteria among pregnant women in this study. Similar high rate of occurrence of *Proteus* spp. has been reported in previous studies [14, 16]. The enzyme urease produced by *Proteus* spp. hydrolyzes urea present in excess amount in the urine producing ammonia that leads to increased pH of the urine which favors precipitation of stones and other UTI complications[39].

The only gram positive bacteria isolated in the current study was *Enterococcus spp.*, 11(19.6%) which is in line with previous reports from Gana and Kenya [14, 34], whereas previous studies from Ethiopia on pregnant women with ASBU did not report *Enterococcus* spp. [15, 16]. This difference may be due to difference in socio-economic characteristics, season of the study, clinical and background characteristics.

Overall, rate of occurrence of resistance to antimicrobials tested in the current study is variable when compared to previous studies. Some of the isolates were also resistant to ciprofloxacin and ceftriaxone, antimicrobials commonly used for treatment of various infectious pathogens. Compared to isolates from pregnant women with ASBU previously in Ethiopia, high rate of resistance to ampicillin was recorded in the current study among gram negative isolates. For instance only 68.8% of isolates of *E. coli* were resistant to ampicillin [15] in previous study from south Ethiopia whereas 100% resistance was recorded in the current study. On the other hand, same previous study reported 43.8% resistance to ceftriaxone while only 17.8% resistance was detected in the current study. A study from north Ethiopia reported 100% resistance to ampicillin and 5.2% resistance to ceftriaxone [16]. Another study from Kenya also reported 74.1% resistance of *E. coli* to cefotaxime another third generation cephalosporin which is very high compared to 18.2% resistance to ceftriaxone in the current study[34]. Resistance to sulfamethoxazole + trimethoprim is only 5.9% in *E. coli* isolates in the current study whereas high as 47.4% and 82.2% resistance was reported in previous studies [15, 16], in Ethiopia. However, none of the *E. coli* isolates from study in Uganda were resistant to Sulfamethoxazole + trimethoprim[40].

High level of resistance to penicillin, oxacillin, and clindamycin was also detected in *Enterococcus* isolates in this study. Recent study from Uganda, reported 50% resistance to ciprofloxacin and 100% resistance to amoxicillin + clavulanic acid whereas in the current study, only 9.1% and 54.5% resistance was detected, respectively[40]. The reason for difference among studies could be due to variation in level of irrational use of antimicrobials among pregnant women and the community in each study area.

Most of the bacterial isolates in the current study were resistant to two or more antimicrobials tested. Previous study from Ambo town also reported resistance to 2 or more antimicrobials in all of the bacterial isolates from pregnant women with symptomatic urinary tract infection and those with ASBU[41]. Detection of high level resistance to ampicillin in all of *E. coli* and *Citrobacter* spp. in the current study shows minimal use of this antimicrobial to treat infections caused by these organisms in the area. The finding of this study revealed that 27.3% of the *Enterococcus spp.*, isolates were resistant to vancomycin, which is lower than study finding from India that reported over 80% resistance [42]. This difference may be due to difference in socio-demographic, background characteristics, and difference in awareness level of transmission and/or prevention of infectious bacteria, and/or difference in extent, frequency and/or manner of antimicrobial use. Some of the isolates detected in the current study were multidrug resistant to about 6–7 antimicrobials in the case of gram negative organisms and one of the *Enterococcus* isolate was resistant to 9 antimicrobials suggesting rapid action on prudent use of antimicrobials in the study area.

Even though, the data generated from this study gives significant scientific evidence on status of ASBU in the study area, the fact that the number of pregnant women involved in the study was small and the interview was based on self-report rendered to recall bias and social desirability bias. Hence, it may not be generalized to the wider community.

Conclusions

This study showed 15.7% prevalence of ASBU in pregnant women in Addis Ababa with the possible risk of developing to symptomatic UTI and associated complication. High rate of resistance to antimicrobials commonly used to treat UTI infection has been recorded in bacterial isolates. Hence routine screening for ASBU during antenatal visit is likely to result in early treatment and minimize complication to the mother and fetus. It is also recommended to assess sensitivity of isolates to commonly prescribed antimicrobials rather than treating empirically.

Abbreviations

ASBU: Asymptomatic bacteriuria

CFU: Colony forming unit

CLSI: Clinical Laboratory Standards Institute

MDR: Multi-drug resistant

UTI: Urinary tract infection

Declarations

Ethics approval and consent to participate

Study was approved by the Institutional Review Board of Aklilu Lemma Institute of Pathobiology, Addis Ababa University and Addis Ababa Health Bearou. Permission was obtained from administration office of each of the study hospital's health care specialty centers. Purpose of the study was clearly explained to the health care professionals working in the antenatal clinics. Informed verbal consent was obtained from each study participant before initiation of data and sample collection after purpose of the study was explained. The study participants were informed that their participation is not mandatory and they can refuse to participate or withdraw from the study at any time.

Consent for publication

Not applicable

Availability of data and materials

All data that were used to support the findings of this study are included within the article.

Competing interests

The authors declare that they have no competing interests.

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Authors' Contributions

KB and TE participated in conception of the study. KB was involved in sample collection, laboratory investigation and preparation of the draft manuscript. GM contributed in the study design, data summarization and critically reviewed the draft manuscript. HA participated in laboratory work. WA participated in preparation of the manuscript. All authors read and approved the final manuscript.

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