

# Antimicrobial Resistance and Extended Spectrum Beta-Lactamase Profile of Uropathogens Among Pregnant Women Attending Antenatal Care at Edna Adan Hospital, Hargeisa, Somaliland

Hussien Mohamoud

Edna Adna University

Senait Tadesse

Bahir Dar University

Awoke Derbie (✉ [awe.love2000@gmail.com](mailto:awe.love2000@gmail.com))

Bahir Dar University <https://orcid.org/0000-0002-6949-3494>

---

## Research

**Keywords:** Bacteriuria, Urinary tract infection, pregnant women, Antimicrobial resistance, Edna Adan Hospital, Hargeisa

**Posted Date:** May 11th, 2020

**DOI:** <https://doi.org/10.21203/rs.3.rs-26986/v1>

**License:** © ⓘ This work is licensed under a Creative Commons Attribution 4.0 International License. [Read Full License](#)

---

## Abstract

**Background** The emergence and spread of antimicrobial resistance (AMR) among uropathogens is increasing, especially in resource limited settings due to a number of reasons. The emergence of drug resistance and particularly the production of Extended Spectrum  $\beta$ -Lactamase (ESBL) by some strains of *E. coli* and methicillin resistance of *Staphylococcus species*, limits the choice of antimicrobials in the treatment of urinary tract infection (UTI). However, little is known about the bacteriology of UTI among pregnant women in Hargeisa, Somaliland

**Methods** A cross-sectional study was conducted in the period of 1 Feb to 30 May 2019 among pregnant women at Edna Adan Hospital (EAH), Hargeisa. Following the standard procedure, clean-catch mid-stream urine samples were collected and processed for bacteriological culture. A urine sample was considered positive for significant bacteriuria (SBU) when a single organism was cultured at a concentration of  $\geq 10^5$  Colony Forming Units/ml. Antimicrobial sensitivity testing (AST) was done using Kirby-Bauer disc diffusion technique. Ceftazidime (30  $\mu$ g) and Cefotaxime (30  $\mu$ g) disks were used for ESBL screening as per CLSI guideline and each ESBL screening positive isolate were phenotypically confirmed by a combination disk test.

**Results** Among 376 study participants, 79 (21.0%) had SBU. Majority at 58(73.4%) of the isolates were Gram-negative. The most predominant isolate was *E.coli* at 36(45.6%) followed by *K. pneumoniae* 16(20.3%) and *S. aureus* at 9(11.4%). The proportion of ESBL producing isolates was at 25(32.9%). Gram-negative bacteria showed high level resistance to ampicillin, amoxicillin, cefotaxime, and cephalexin at 87%, 85%, 57%, and 52%, respectively. Previous history of UTI, monthly income, educational status and having dysuria were significantly associated with SBU ( $p < 0.05$ ).

**Conclusions** Most of the isolates were found resistant to the commonly prescribed antimicrobial drugs. Therefore, actions to minimize AMR should be in place to reduce the impact of urinary tract infections among pregnant women. Future large scale study is warranted to find out bacteriological and other factors associated with ESBL producing uropathogens.

## Introduction

Although the bacteriology and epidemiology of urinary tract infection (UTI) is not well documented in resource limited settings, it is one of the most common health problems during pregnancy next to anemia. If UTI is not properly and effectively controlled, it can seriously affect the infant health or the pregnant women. Absence and delay in the detection of AMR and ESBL producing uropathogenic bacteria is associated with prolonged hospital stay, increased morbidity and mortality in pregnancy [1]. As a result, frequent and consistent evaluation and study of the prevalence, etiologic agents, and predisposing factors of UTI during pregnancy is necessary in developing countries like Somaliland in order to reduce its devastating effects during pregnancy on both maternal and fetal health [2]. In many parts of Somaliland antimicrobials have been widely used irrationally. Thus, there might be an increasing incidence of microbial resistance to commonly used antibiotics for the treatment of UTI in the country. Therefore, knowing the type of the isolates and the magnitude of drug resistance is critically important as the changing rate of antibiotic resistance has a large impact on the empirical therapy of UTI in pregnant women [2].

In Edna Adan Hospital, same as other similar settings in Somaliland, routine culture and antibiotic susceptibility testing are not performed as an essential part of antenatal care and the most treatment regimen is based on empirical therapy. This may lead to the overuse of antibiotics and development of resistant microbial species. However, there is no published information on the prevalence of bacterial profile of UTI among pregnant women and their antimicrobial susceptibility profile in the study area. Moreover, the information gap in ESBL producing bacterial uropathogens is more significant in the country.

Therefore, the aim of the current study was to assess the bacterial, antimicrobial resistance and ESBL profile of uropathogens among pregnant women attending antenatal care at Edna Adan Hospital, Hargeisa Somaliland.

## Materials And Methods

### Study setting, design and period

A hospital based cross-sectional study was conducted from 1 Feb 2019 to 30 May 2019 in EAH, Hargeisa, Somaliland. The hospital is located in Maroodi Jeex Region, the capital city of Somaliland known as Hargeisa. EAH is found in the southern part of Hargeisa. Based on census conducted in 2006, Hargeisa had a total population of 1.5 million [3]. The city had one referral Hospital, two general Hospitals, seven health care centers and five private Hospitals and other several private clinics. The AEH is one of the largest maternity private hospitals in the city which provides health services for the community especially, maternal and child health services, for patients from all parts of Somaliland and other neighborhood regions such as Puntland and Southern Somalia. Edna Hospital was founded by the famous lady in the context of Somalia and the world as well.

## Population, sample size and sampling technique

a total of 384 study participants were included in the study. The study population was pregnant women attending ANC at Edna Adan Hospital during the study period. Convenient sampling technique was used to enroll consecutive pregnant women attending antenatal care in the hospital during the study period who fulfilled the inclusion criteria. Pregnant women with or without symptoms of urinary tract infection who were willing to participate in the study were included. Those who took antibiotics two weeks before the time of data collection period were excluded from the study.

## Data collection procedures

Structured questionnaire that has been translated into the local language was used to collect demographic characteristics of the study participants and related clinical data. Pregnant women were screened for UTI clinically by health practitioners in charge of attending them. In addition, the types of isolated bacterial uropathogens and the ESBL producing bacteria from urine culture with their respect antimicrobial susceptibility profile were determined as per standard bacteriological protocol.

## Urine sample collection and handling

After appropriate instruction pregnant women were given pre-labeled leak proof, wide mouth, and sterile, screw-capped plastic container to collect 5–10 mL mid-stream urine (MSU) specimen. Then all samples were immediately transported to the bacteriology department at EAH for culture and antimicrobial susceptibility testing (AST). Using calibrated wire loop samples were inoculated in to Cystine Lactose Electrolyte Deficient medium (CLED). Cultures were incubated overnight in aerobic atmosphere at 37 °C for 24 hours. Colonies were counted to check the presence of significant growth. Colony counts yielding bacterial growth of  $\geq 10^5$  CFU/ml of urine was regarded as significant bacteriuria (SBU); but specimens that produced  $< 10^5$ CFU/ml were considered insignificant [4].

Colonies from CLED were then sub cultured into MacConkey and blood agar plates, then incubated at 37 °C for 24 hours. Identification of bacterial species was done using colony characteristics, gram staining and panel of biochemical tests following the standard procedure. The gram negative bacteria were identified by indole, H<sub>2</sub>S production in KIA agar, citrate utilization, urease test, motility test, oxidase and carbohydrate utilization tests. Catalase and coagulase tests were also employed to identify gram-positive isolates.

## Antimicrobial susceptibility testing (AST)

The Kary-Baur disc diffusion method was used for AST on Muller Hinton agar (MHA) (Oxoid, Ltd, England) as per the Clinical Laboratory Standards Institute guideline. Identical 3–5 pure colonies from overnight cultured specimen were suspended in 5 ml sterile nutrient broth (Oxoid, Ltd,England) and mixed thoroughly to make the suspension homogenous. The inoculum turbidity was adjusted to 0.5 McFarland standards. Then, the bacterial suspensions were seeded on the surface of the MHA using a sterile cotton swab. The antimicrobial impregnated disks were placed on the media using sterile forceps and plates were incubated at 37°C for 24 hours and the zone of inhibition was measured and interpreted as sensitive, intermediate and resistant as per the CLSI protocol. The following disks were used for gram negative bacteria; Amoxicillin (AML, 25 µg), Ceftriaxone (CRO, 30 µg),

Cefotaxime (CTX, 30 µg), Amoxicillin-clavulanic acid (AMC, 20/10 µg), Nitrofurantoin (F, 300 µg), Norfloxacin (NOR, 10 µg), Cephalexin (CN, 30 µg) and Ceftazidime (CAZ, 30 µg). Similarly, Ampicillin (AMP, 10 µg), Norfloxacin (NOR, 10 µg), Cefotaxime (CTX, 30 µg) and Amoxicillin (AML, 25 µg), were also used for gram-positive isolates. These disks were selected based on the CLSI (CLSI, 2018) and by considering the availability and frequent prescriptions of these drugs for the treatment of urinary tract infections in the study area.

**Extended spectrum beta-lactamase detection:** Initial screening for ESBL was done by the diameters of zones of inhibition produced by either Ceftazidime (30 µg) or Cefotaxime (30 µg) from the AST on MHA according to the CLSI screening criteria. These breakpoints indicated of suspicion for ESBL production were: for Ceftazidime (30 µg) ≤ 22 mm and for Cefotaxime ≤ 27 mm. After this initial screening was done, phenotypic detection of ESBL production was confirmed by Combined Disk (Double Disk Potentiate) test according to CLSI guidelines (CLSI, 2018).

## Quality control

Specimen collection was made following the recommended approach. We strictly followed the manufacturers' instruction and bacteriological standard procedures during culture media preparation and AST testing. The standard reference bacteria strains such as *E.coli* (ATCC 25922), *P. aeruginosa* (ATCC 27853) and *S. aureus* (ATCC 25923) were used for quality control of culture and antimicrobial susceptibility testing.

## Data analysis

Data was entered, cleaned and analyzed by using Statistical Software for social package (SPSS) version 23. Generated data were compiled by frequency tables and figures and other statistical summary measures. The proportion of uropathogenes was calculated. Similarly, the proportion of AMR to a specific drug was calculated. Chi square ( $\chi^2$ ) was considered to find out factors associated with culture positive urine samples and statistical significance was set at  $p$  value < 0.05.

## Results

### Demographic And Clinical Characteristics Of The Study Participants

Of the total 384 study participants involved in the stud, the information from eight of the study participants, including the collected urine volume was considered insufficient thus excluded from the analysis. Therefore, data of 376 pregnant women were included in this study. The majority of the study participants were in the age group of 26–35 years 183(48.7%), married 368(97.9%), don't write or read 135(35.9%), urban dwellers 344(91.5%) and multiparous 239(63.6%). Approximately 88(23.4%) 147(39.1%) and 161(42.8%) of the study participants were in their third trimester, had previous history of UTI and their income was between 200–400 USD, respectively (Tables 1 and 2).

Table 1  
**Socio-demographic Characteristics of Study  
 Participants in Edna Adan Hospital, May 2019.**

<b>Variables</b>		
	<b>N</b>	<b>%</b>
Age in years		
15–25	175	46.5%
26–35	183	48.7%
36–45	18	4.8%
Residence		
Urban	344	91.5%
Rural	32	8.5%
Educational status		
Illiterate	135	35.9%
Only R&W	52	13.8%
Primary School Completed	44	11.7%
Secondary School Completed	62	16.5%
University or College Completed	83	22.1%
Monthly income		
<b>Less Than 200 USD</b>	161	42.8%
200–400 USD	82	21.8%
400–600 USD	101	26.9%
600–800 USD	12	3.2%
Greater Than 800 USD	20	5.3%
Gravidity		
Multigravida	287	76.3%
Primigravida	89	23.7%
Parity		
Nulipara	70	18.6%
One	67	17.8%
Multipara	239	63.6%
Gestation period		
First Trimester	88	23.4%
Second trimester	127	33.8%
Third trimester	161	42.8%

Table 2  
Clinical characteristic of the study participants at Edna Adan Hospital, May 2019.

Characteristic	Yes n(%)	No n(%)
Dysuria	148(39.4%)	228(60.6)
Increased Frequency	92(24.5%)	284(75.5%)
Urgency	93(24.7%)	283(75.3%)
Hematuria	19(5.1%)	357(94.9)
Fever & Chills	89(23.7%)	28776.3%
Flank Pain	80(21.3%)	296(78.7%)
History of Catherization	40(10.6%)	336(89.4%)
History of UTI	147(39.1%)	229(60.9%)
History of Diabetes Mellitus	28(7.4%)	348(92.6%)
History of Hospitalization	25(6.6%)	35193.4%
History of Antibiotic use	86(22.9%)	290(77.1%)

## The identified uropathogens

Of the total 376 processed urine samples, 79 (21%) were positive for significant bacteriuria. Majority at 58(73.4%) were Gram-negative while the remaining at 21(26.6%) of the isolate were Gram-positive. The most predominant isolate was *E.coli*, 36(45.6%) followed by *K.pneumonea* 16 (20.3%) and *S. aureus* 9 (11.4%) (Fig. 1). The distribution of isolates among symptomatic and asymptomatic pregnant women for UTI was at 55(69.6), and 24(30.4), respectively.

## Antimicrobial resistance and ESBL profile of the isolates

With regard to antimicrobial resistance profile of the isolates, majority of Gram-negative isolates showed resistance against ampicillin at (87%), Amoxicillin (85%), Cefotaxime (57%) and Cephalexin at (52%) and Nitrofurantion was found to be effective against majority of the isolates. All *S. aureus* isolates were found 100% sensitive to Amx-clavulanic acid, Ceftriaxone, Nitrofurantion, Ceftazidime, Norfloxacin, Cefotaxime and Cephalexin. Similarly, almost all isolates of *Citrobacter* Spp were found sensitive for the tested drugs except ampicillin and Cephalexin (Table 3).

Table 3  
Proportion of ESBL production among the isolates (n = 79), May 2019.

Bacterial Isolates	No. of Isolates	Percent (%)	No. of Non ESBL producers	No. of ESBL Producers
<i>E.coli</i>	36	45.5%	22(61.2%)	14(38.8%)
<i>K.pneumoniae</i>	16	20.3%	11(68.5%)	5(31.3%)
<i>P.aeruginosa</i>	7	8.9%	4(57.1%)	3(42.9%)
<i>P.mirabilis</i>	5	6.3%	4(80%)	1(20%)
<i>S.aerues</i>	9	11.4%	9	-
<i>CoNs Spp</i>	2	2.5%	2	-
<i>Citrobacter Spp</i>	3	3.8%	2(66.7%)	1(33.3%)
<i>Entrobacter Spp</i>	1	1.3%	0	1(100%)
Total	79	100.0%	54	25

The overall proportion of ESBL production was at 25 (32%). Specifically, *P. aeruginosa* 3(42.9%), *E.coli* 14(38.8%) *K. pneumoniae*, 5(31.3%), *P. mirabilis*, 1(20%), *Citrobacter Spp* 1(33.3%) and *Entrobacter Spp* at 1(100%) were found positive for ESBL production. However, among *S. aureus* and *CoNS* isolates there was no ESBL production reported.

## Factors associated with significant Bacteriuria

Previous history of UTI, monthly income, educational status and having dysuria were found to be significantly associated with culture positive urine among pregnant women in Edna Adan Hospital ( $p < 0.05$ ). The rest variables didn't show statistical association (Table 4).

Table 4  
Antimicrobial Resistance profile of the bacteria uropathogens among pregnant women at Edna Adan Hospital, May 2019.

Antibiotics Used	Bacterial Isolates							
	<i>E.coli</i> (n = 36)	<i>K. pneumoniae</i> (n = 16)	<i>Paeruginosa</i> (n = 7)	<i>S. aureus</i> (n = 9)	<i>Proteus Spp</i> (n = 5)	<i>Citrobacter Spp</i> (n = 3)	CoNS (n = 2)	<i>Enrobacter Spp</i> (n = 1)
Ampicillin	18(50%)	14(87.7%)	5(72%)	7(33%)	2(40%)	2( 34.7%)	1(50%)	0(0%)
Amoxicillin	21(59%)	7(44%)	6(86%)	4(45.4%)	2(60%)	0(0.00%)	0(0.00%)	0(0.00%)
Amx-lavulanic acid	32(11.1%)	0(0.00%)	3(57.1%)	0(0.00%)	0(0.00%)	0(0.00%)	0(0.00%)	0(0.00%)
Nitrofurantoin	0(0.00%)	0(0.00%)	0(0.00%)	0(0.00%)	0(0.00%)	0(0.00%)	1(50%)	0(0.00%)
Ceftazidime	5(13.9%)	6(37.5%)	4(57.1%)	1(11.1%)	0(0.00%)	0(0.00%)	0(0.0%)	0(0.00%)
Norfloxacin	28(22.3%)	5(31.2%)	3(57.1%)	0(0.00%)	3(40%)	0(0.00%)	0(0.0%)	0(0.00%)
Cefotaxime	22(61.1.8 %)	9(43.6%)	4(57.1%)	0(0.00%)	0(0.00%)	0(0.00%)	1(50%)	0(0.00%)
Cephalexin	17(47.2%)	9(43.6%)	3(42.9%)	0(0.00%)	1(80%)	1(33.3%)	0(0.00%)	0(0.00%)
Ceftriaxone	30(83.3%)	14(87.5%)	0(0.00%)	9(100%)	4(80%)	3(100%)	1(50%)	0(0.00%)

## Discussion

In the present study a total of 376 pregnant women were included for urine bacteriological culture and AST testing. The proportion of significant bacteriuria was at 79(21%). Although there is no previous study in our setting to compare the finding, the result was found relatively higher than reports in Bahir Dar, Ethiopia (8.5%) [5], Khartoum, Sudan (12.1%) [6] and Makkah, Saudi Arabia (12%) [7] and from Iqbal Memorial Hospital, Bangladesh at (14.6%) [6]. However, our result was also lower than the prevalence reported in Ghana (29.9%) and Nepal (30.5%) [6, 7], respectively. The variation of the reported prevalence of significant bacteriuria among pregnant women across different studies from one country to other or among region of the same country might be attributed to the difference sample size, geographical variations, host factors and social habit of the community and health education practice, environmental conditions and the standard of personal hygiene.

In the present study, Gram-negative were more prevalent at 58(73.4%) than Gram-positive isolates. This finding is comparable to other studies done in Dire Dawa, Ethiopia where (73.1%) of the isolates were Gram-negative [8]. Further, our finding is in-line with the fact that Gram-negative bacteria are the most predominant uropathogens that usually sourced from the bowel and ascend to the urinary tract. They have also unique structures (like, pilus adhesions) which help the bacteria for attachment to the uroepithelium lining and prevent them from urinary lavage, allowing for multiplication and tissue invasion resulting in invasive infections during pregnancy [9].

*E.coli*, 36(45.6%) was the most predominant identified uropathogen followed by *K.pneumonea* at 16 (20.3%). The finding is concurring with the finding from Ambo, Gonder, Ethiopia [10, 4] Libya and India [11]. Our result is also consistent with the well documented knowledge that most UTIs are caused by Gram-negative bacteria like *E. coli* and *Klebsiella spp*. Moreover, in the present study among Gram-positive uropathogens *S. aureus* was found predominant bacteria which accounted for about 9(11.4%). This finding is consistent with the studies conducted in Gondar University teaching hospital, Ethiopia [4]. The AST profile of the uropathogens showed that (87.7%) and (100%) were found resistant to Ampicillin and Amoxicillin, respectively. Majority of Gram-negative isolates found resistant to ampicillin at (87%), Amoxicillin (85%), Cefotaxime (57%) and Cephalexin at (52%). This level of AMR might be attributed by a number of issues including over and misuse of antimicrobials in the study area where there is weak regulatory practice and inadequate bacteriological surveillance due to lack of routine antimicrobial susceptibility testing facilities. Most of the antimicrobials listed are freely available in local pharmacies and people could purchase and use them without prescription. This would also play its big share for high level antimicrobial resistance reported in this study. In the present study, relatively almost all isolates of *S. aureus* and *Citrobacter Spp* were found sensitive for the drugs they were tested. Similarly, Amx-Clavulanic acid and nitrofurantoin were found to be comparatively effective against the uropathogens. Low level of resistance, specifically against nitrofurantoin might be due to its narrow range of clinical indications, which results in less usage. Nitrofurantoin was found to be the most effective drug against *E.coli* followed by Amx- Clavulanic acid. Hence, Nitrofurantoin can be considered in the present study as one of the drugs of choice to treat UTI in pregnant women where multi-drug resistant uropathogens are prevalent. Our finding is in agreement with a report by [13] that stated nitrofurantoin to be the most effective drug against uropathogenic *E. coli*.

ESBL-producing *uropathogenes* have become a problem worldwide. Dissemination of ESBLs compromises the activity of broad-spectrum antibiotics creating major therapeutic difficulties with a significant impact on the outcomes for patients The magnitude of ESBL producing organism among clinical isolates vary greatly worldwide and changing over time [12] The present study revealed that, the overall prevalence of ESBL production was at 25 (32%). A similar study by [11] in India reported 48.3% level of ESBL proportion which is higher than our report. In the present study specifically, *Paeruginosa* was found to be the higher ESBL proportion at 42%, followed by *E.coli* at 38.8%. This finding was relatively lower than a study conducted in Bangladesh that reported ESBL profile of *E. coli* at (60%) and *K. pneumoniae* at (40%) [14] but relatively was higher reports from Iran at (21%) and (12%), respectively [15]. Relatively higher level of ESBL producing *E.coli* and *K. pneumoniae* was also reported from Latin America (54.4% and 8.5%), the Western Pacific (24.6% and 7.9%) and Europe (22.6% and

## 5.3%)

## Conclusions

The study revealed a prevalence of 21% significant bacteriuria among pregnant women in EAH.

*E. coli* was the most predominant isolate followed by *Klebsiella Spp* and *S. aureus*. A large number of the isolates were found resistant to the commonly prescribed antimicrobials. However, low level of resistances was detected against Norfloxacin, Nitrofurantion and Amoxicillin-clavulanic acid and hence could be used as an empirical therapy for UTI in the study area. The overall proportion of ESBL production was at 31.6%; specifically 38.8%, 31.3% and 42.6.5% of *E.coli*, *K. pneumoniae* and *P. aeruginosa* were positive for ESBL production. Low level of income, previous history of UTI and having dysuria were found to be significantly associated with SBU. Therefore, continuous health education, rational use of antimicrobials, collaborative regular surveillance of pathogens associated with UTI with their antimicrobial resistance pattern should be done to reduce the magnitude of bacteriuria among pregnant women. Further study should be considered to molecularly characterize the isolates and to identify bacteriological factors associated with ESBL production.

## Declarations

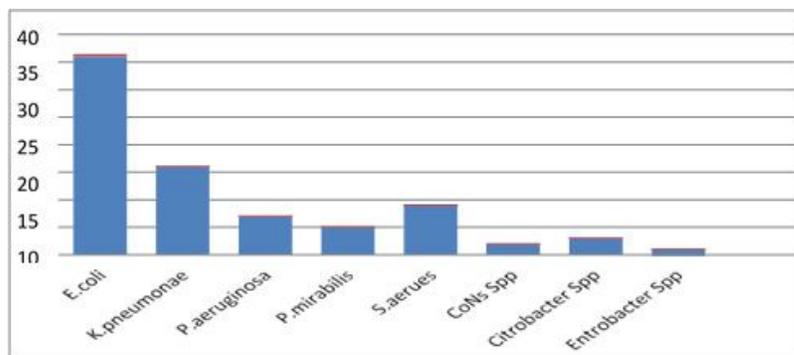
- **Ethical approval:** An ethical clearance letter was obtained from the institutional review board (IRB) of college of medicine and health science, Bahir Dar University. Following well-versed about the purpose and importance of the study, informed written consent was obtained from all the study participants. Information obtained during this study was kept confidential and used only for the study purpose. Bacteriological positive results were communicated for health professionals attending the pregnant women for better
- **Data availability:** all the generated data are included in this
- **Competing interests:** authors declare that they have no competing
- **Funding:** this project is partially funded by Bahir Dar University,
- **Authors' contributions:** HM and AD conceive the research idea. HM has also involved in the data collection and interpretation of the result. AD has involved in data analysis and evaluating the scientific content of the study. ST has involved in the rationalizing the method section and manuscript preparation. All authors read and approved the final manuscript for submission.
- **Acknowledgment:** Authors would like to thank Bahir Dar University for the funding. We would also like to acknowledge the study participants and the insightful guidance of Edna Adan Ismail founder and Chancellor of Edna Adan University, Hargeisa, Somaliland.

## References

1. Hoban DJ, Nicolle LC, Badal LE, Bouchillon R S. Antimicrobial susceptibility of Enterobacteriaceae, including molecular characterization of extended-spectrum beta- lactamase-producing species, in urinary tract isolates from hospitalized patients in North America and Europe. *Diag Microbiol Infect Dis*. 2010;8(6):74-62-74.
2. Rettedal S, Bernhoff LI, Natås E, Sundsfjor OB. Extended-spectrum  $\beta$ -lactamase- producing Enterobacteriaceae among pregnant women in Norway: prevalence and maternal– neonatal transmission. *J Perinatol*. 2015;18):907–12. Central Statistics Department of Somaliland).
3. Alemu A, Moges F, Yitayal Shiferaw Y, Tafess K, Kassu A, Anagaw B, Agegn A. Bacterial profile and drug susceptibility pattern of UTI in pregnant women at University of Gondar teaching hospital. *BMC Red Notes*. 2012;25(5):197.
4. Tazebew D, Getenet B, Selabat M, Wondewsen T. Urinary bacterial profile and antibiotic susceptibility pattern among pregnant women in Northwest Ethiopia. *Ethiop J Health Sci*. 2012;22(2):121–8.

5. Hamdan ZH, Abdel HMZ, Salah KA, Ishag A. Epidemiology of urinary tract infections and antibiotics sensitivity among pregnant women at Khartoum North Hospital. *Ann Clin Microbiol Antimicrob.* 2011;10:2.
6. Hani SF, Ahmed MA, Ghada AAE, Ahmad KA, Amr MM. Urinary tract infections among pregnant women in Makkah, Saudi Arabia. *Biomed Pharma J.* 2013;6(1):01–7.
7. Behailu D, Kedir, Zelalem. Fitsum Weldegebreal 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, *Therapeutics and Ris Mgt* 21(9) 57–62.
8. Onkon. M. (2014). Extended-spectrum  $\beta$ -lactamase producing bacteria causing community- acquired urinary tract infections in children. *Pediatr Nephrol*, 1583–1587.
9. Yonas G, Leta (2017) Urinary pathogenic bacterial profile, antibiogram of isolates and associated risk factors among pregnant women in Ambo town, Central Ethiopia.
10. Tankhiwale SS, Jalgaonkar SV, Ahamad S, Hassani U. Evaluation of extended spectrum beta lactamase in urinary isolates. *Indian J Med Res.* 2014;120:553–6.
11. Behrooozi A, a. RM Y. J. Frequency of extended spectrum beta lactamase (ESBLs) producing *Escher-ichia coli* and *Klebsiella pneumoniae* isolated from urine in an Iranian 1000-bed tertiary care hospital. *African J Microbiol Res.* 2010;6:112–25.
12. Moyo SJ, Aboud S, Kasubi M, Maselle SY. (2010). Bacterial isolates and drug susceptibility patterns of urinary tract infection among pregnant women at Muhimbili National Hospital in Tanzania. *Tanzan J Health Res*12:236 – 40.
13. Selvakumar BN, Jasmine R. (2011). Prevalence and antibacterial resistance of ESBLs among pregnant women with UTI. *IJPSR*(11) 2846–8.
14. Ahmed I, S. A. (2011). Extended spectrum  $\beta$  –lactamases and bacterial resistance. *Pakistan Journal of Medical Science* (4), 51–55.

## Figures



**Figure 1**

Frequency and type distribution of the identified uropathogens among pregnant women at EAH