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Original Article

Prevalence, Risk Factors and Antimicrobial Resistance of Enterococci caused Urinary Tract Infection among People Living with HIV in Addis Ababa, Ethiopia

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Abstract

Background: Urinary tract infections (UTIs) are among the most common infections worldwide, affecting millions of people each year. The antimicrobial resistance characteristic of Enterococci worsens complications among this vulnerable population. This study aimed to estimate the prevalence of Enterococci-caused UTIs, their risk factors, and antimicrobial resistance profile among people living with HIV in Addis Ababa, Ethiopia.
Methodology: Hospital-based cross-sectional study was conducted from October 2022 to April 2023. Presumptive Enterococci were identified using standard microbiological culture and biochemical tests and confirmed using Matrix-Assisted Laser Desorption Ionization-Time of Flight of Mass Spectrometry at the species level.
Results: This study revealed that among the (n= 102) people living with HIV-acquired culture-confirmed UTIs with diverse bacterial uropathogens, (n= 20; 19.6%) were acquired UTIs associated with *Enterococcus* species: *E. faecalis* 80% and *E. faecium* 20%**.** Earning monthly income <3000 Ethiopian birr with (adjusted OR) =3.19; (95% CI: 1.05, 9.66) and having exposure to anti-tuberculosis drugs (Adjusted OR = 13.62; 95%CI: 3.53, 52.63) were positively associated with the occurrence of Enterococci-caused UTI. All Enterococci isolates had multi-drug and extensive drug-resistance strains.
Conclusion: The study concluded a higher prevalence of Enterococci-caused UTIs, with predicting factors: lower income per month, and exposure to antituberculosis drugs, and high level of antimicrobial resistance. Hence, there should be a targeted intervention that could tackle the higher prevalence of infection and antimicrobial resistance among these vulnerable populations, steering the identified predicting factors.

Keywords: Enterococci*; Enterococcus faecium, Enterococcus faecalis;* Urinary tract Infections; People Living with HIV

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Introduction

Urinary tract infections (UTIs) are among common infections across all age groups and both sexes, affecting millions of people annually both in the community and hospital settings[1, 2]. Enterococci are among the common bacterial uropathogens that cause UTIs, accounting for over 30% of all bacterial isolates[3]. Enterococci are Gram-positive commensals in the gastrointestinal tracts of humans and animals[4],cause opportunistic infections, particularly among vulnerable populations such as older age, those who frequently use broad-spectrum antimicrobials, those with indwelling catheters, those with diminished host immunity like people living with HIV (PLHIV)[5, 6]. The principal reason why PLHIV are at heightened risk of acquiring UTIs associated with enterococci is the weakened immunity [7–9],and a complex process that the bacteria uses to escape the host's defense mechanism, via increasing their virulence and ability to resistant microbials[10].Worldwide, Enterococci species, such as *E. faecalis* and *E. faecium* ranks the 3rd leading cause of nosocomial infections next to *S. aureus* and *P. aeruginosa[10, 11]*with increasing prevalence and rapid development of resistance to a broad range of antimicrobials[3]. For instance, estimates suggested that *E. faecium* accounts for 5-10% of these infections, whereas *E. faecalis* is responsible for about 85-90% of the infection rate[4, 11, 12]. Enterococci are associated with both uncomplicated and complicated UTIs linked to healthcare, by both vancomycin-resistant and non-vancomycin-resistant *E. faecalis*, and *E. faecium* species[1, 12]. Further, the clinical significance of Enterococci is emphasized by their naturally low sensitivity to various antimicrobials, such as aminoglycosides, cephalosporins, and sulphonamides[13].

Although *E. faecalis* has developed resistance to aminoglycosides, its resistance to ampicillin and vancomycin is considerably less common, compared to its resistance among *E. faecium*[14]. Vancomycin-resistant Enterococci are not only challenging treatments associated with Enterococci associated infections but also serve as a means of transmitting antimicrobial-resistant genes to other species, particularly for *S. aureus*[15]. Enterococci are the most common cause of UTIs among immune-compromised individuals like PLHIV[16], with reported prevalence, ranging from 0.7% to 38.8%[11–17].Although limited studies were conducted in Ethiopia, a few studies revealed the prevalence of Enterococci-caused UTIs ranges from 3.2-80.0%[18–21]. Enterococci caused infections should be managed with suitable antimicrobials, due to their antimicrobial resistance characteristics to various antimicrobials, reflecting their propensity for developing multidrug resistance[19, 21].Addressing UTIs caused by Enterococci can be difficult due to the bacteria's antimicrobial resistance characteristics, alongside the global overuse/misuse of antimicrobials that has been associated with increasing levels of antimicrobial resistance[5].This could be the reason, why existing literatures recommend treating infections with concrete evidence that affirms the individual has the infection, and accompanying susceptibility testing for possible antimicrobial resistance[21].

Understanding the characteristics of the bacteria, like its biofilm formation, and specialized virulence factors, including its antimicrobial resistance characteristics, is crucial for guiding clinical decision-making and antimicrobial stewardship efforts. This study aimed to determine the prevalence Enterococci linked UTIs, their risk factors, and antimicrobial resistance profile among PLHIV acquired UTIs in Addis Ababa, Ethiopia. Identifying the burden and correlations of Enterococci-caused UTIs, as well as the patterns of antimicrobial resistance, can inform appropriate prevention strategies for the infection and address the rising antimicrobial resistance in this population.

Methodology

Study Setting, Study Design, and Period

This study is a subset of our previously published article [22]. The total sample size of the published article was 688 participants, with 518 from Addis Ababa and 170 from Adama. Among these, 144 individuals have culture-confirmed UTIs, caused by diverse bacterial uropathogens, with 102 individuals from Addis Ababa and the remaining 42 from Adama. Although a variety of bacterial uropathogens were identified, a notable finding is that *E. faecalis* was detected only in Addis Ababa, not in Adama. This incongruity forces us to further investigate, the *E. faecalis* known as more prevalent, causes 80–90% of human infections, butis more susceptible to antimicrobials, while *E. faecium* is less prevalent and causes 5–15% of human infections[23]. For instance, CDC National Healthcare Safety Network reported, among 20,000 catheters associated UTIs, 50% were caused by *E. faecalis*, 20% by *E. faecium*, and 30% other Enterococci spp., with 85% of the *E. facium* were vancomycin resistant [4].In contrast, the strains identified from Adama: *E. faecium* and *E. hirae* are generally less prevalent, but more resistant to antimicrobials [4, 10, 23], and *E. hirae* is also reported as rarely causing UTIs [24].

Therefore, the focus of this study, Enterococci associated UTIs was conducted in four referral hospitals of Addis Ababa, the capital city of Ethiopia[25], with over five million population in the year 2022 [26]. This hospital-based cross-sectional study was carried out among people living with HIV attending selected antiretroviral therapy (ART) clinics in Addis Ababa between October 2022 and April 2023. The ART clinics purposely selected were affiliated with Tikur Anbesa Specialized Hospital, Zewditu Memorial Hospital, Menilik the II Memorial Hospital, and Ras Desta Memorial Hospital.

Sample Size and Recruitment Methods of Study Participants

Initially, the sample size was estimated using the formula:$n = \frac{(Z)^2 p(1-p)}{e^2}$; where z is the standardized score at 97%confidence interval; e= margin of error; P is the estimated proportion of the eligible population with UTIs, and n = total estimated sample size. Thus, considering a 0.103 proportion[27], 97% confidence interval, 0.03 margin of error, and 7.5% non-response, the total estimated sample size was 520. Finally, 102 PLHIV acquired culture-confirmed UTIs with diverse bacterial uropathogens were targeted for this study to determine the prevalence of UTIs associated with Enterococci, its associated risk factors, and antimicrobial resistance.

Inclusion and Exclusion Criteria

The exclusion criteria used to recruit the 520 people living with HIV were: (a) people living with HIV who consumed two or more glasses of fluid within an hour before clinic attendance, due to its diluting capacity of the urine, ultimately reduces the bacterial concentration, (b) those who received antimicrobials within a week prior to the clinic visit, due the antimicrobials bacteriostatic/bactericidal effect continues for some periods after completing the antimicrobial, ultimately affects the UTI test results, (c) those with confirmed sexually transmitted diseases(STDs), as it exhibits symptoms overlapping with UTI, (d) women who were lactating, and pregnant, due to the immune suppression of the women, results in a surplus risk of acquiring UTIs and, menstruating women, could be due to the considerable lowering level of estrogen during the menstrual period and/or the blood may contaminate urine samples affects the testing result, (e) individuals under 18 years of age were also excluded. The detailed sample size, sampling, and laboratory investigation procedures were clearly written in our previously published article (Ketema et al,2024) [22].

Data, Urine Sample Collection, Quality Control, and Testing Procedure

Data was collected through face-to-face interviews, and chart review method using an expert-validated, structured questionnaire with a content validity index of 0.82, which indicates a high level of agreement among experts, the items are relevant enough to measure the intended constructs on the items derived from related literature[20, 28]. Information such as socio-demographic and background characteristics were gathered through interviews while study variables like HIV clinical staging, exposure type of antiretroviral drug, exposure to the anti-tuberculosis drug, and outcomes of treatment for tuberculosis, a load of HIV RNA copies, weight, and height to determine nutritional status were obtained through a review of the study participants' medical charts by trained data collectors. Culture-confirmed UTI was defined as a colony-forming unit (cfu) count of $\geq 10^5$/ml for those without UTI symptoms while a cfu count of $\geq 10^2$/ml for those with UTIs symptoms was considered as having UTI [29–31]. Identification of Enterococci was done using routine microbiology techniques, and biochemical tests (catalase and KOH tests) (Remel Europe Ltd, Dartford, UK) [31] using *Staphylococcus aureus (ATCC25923*) as quality control bacteria[31, 32].Finally, the presumptive bacterial uropathogens were confirmed using Matrix-Assisted Laser Desorption Ionization-Time of Flight of Mass Spectrometry (MALDI-TOF) at the species level [33].

Antimicrobial Susceptibility Test and Multiple Antimicrobials Resistance (MAR) Index

The isolated bacterial strains were tested against 18 antimicrobial agents using a disc diffusion method based on Clinical and Laboratory Standards Institute (CLSI) guidelines [34, 35]. Antimicrobial discs: gentamicin(gm:10μg); streptomycin(s:10μg); amikacin(an:30μg); kanamycin(k:30μg); nalidixic acid(na:30μg), amoxicillin + clavulanic acid(amc:20/10μg), amoxicillin (amx:30μg), ceftriaxone(cro:30μg), cephalothin(cf:30μg), cefoxitin(fox:30μg), ciprofloxacin(cip:5μg), sulfamethoxazole+ trimethoprim(sxt:23.75/1.25μg), tetracycline(te:30μg), chloramphenicol(c:30μg), azithromycin(azm:15μg), erythromycin(ery:15μg), clindamycin(cd:2μg), nitrofurantoin(f:30μg) (Sensi-Discs, Becton, Dickinson and Company, Loveton, USA) were used to determine the antimicrobial susceptibility profile of the bacterial isolates.

In terms of interpreting the antimicrobial resistance level (a) being resistant to at least one in three/more antimicrobial categories was considered multi-drug resistant (MDR); (b) being resistant to at least one in all but two/fewer antimicrobial categories is regarded as extensive drug resistance(XDR); and (c) being resistant to all antimicrobial categories tested was considered as pan-drug resistance(PDR)[36, 37].

The multiple antimicrobial resistance index was calculated by the ratio $MARI = \frac{(x)}{(y)}$ in which x = the number of antimicrobials to which an isolate is resistant and y = the total number of antimicrobials used in the study [38].

Data Analysis

Data analysis was done using SPSS version 23.0. Associations between Pré-determined factors and the occurrence of Enterococci-caused UTIs were assessed using binary logistic regression analysis. Significant associations were reported at *P -value* <0.05.

Ethical Consideration

The Institutional Research Ethics Review Board of the College of Health Sciences (IRERB) Minutes Ref No.: AAUMF 03-008) and Aklilu Lemma Institute of Pathobiology, Addis Ababa University (IRERB Minutes Ref No.: ALIPB IREC/86/14/22) reviewed the protocol and provided ethical clearances. The procedures and aims of the study were explained to the study participants before obtaining written consent from them.

Results

Background Characteristics

A total of 102 PLHIV acquired culture confirmed UTIs with diverse bacterial uropathogens were included in this study. The majority (n=63; 61.8%) of the study participants were within the 35-49 years age group, with a median age of 42 years (interquartile range (IQR)= 38-50 years). The majority were females (n=65; 63.7%), resided in an urban area (n=64; 62.7%), were married (n=52; 51.0%), and attended at least secondary education (n=63; 61.8%). While those employed were (n= 58; 56.9%) and with (n=67; 65.7%) having a monthly income of ≥3000 Ethiopian birrs per month. Over half of the study, participants have normal nutritional status (n=53; 52%), and did not have a history of taking anti-tuberculosis drugs (n=61; 59.8%). The practice of vaginal douching/perineal care at two or fewer times per day was reported in (n=58; 56.9%) participants.

A considerable (n= 32; 31.2%) proportion of the study participants had comorbid chronic diseases like diabetes mellitus, hypertension, renal caliculi, and/or a previous history of UTIs, and (n= 12; 11.8%) were receiving antiretroviral drug containing zidovudine. Seven (n= 07; 6.9%) of the study participants had HIV RNA ≥200 copies per milliliter (Table 1).

Prevalence of Enterococci caused UTIs

Among the total 102 PLWH acquired UTIs with diverse bacterial uropathogens, about one fifth (n= 20; 19.6%) were associated to Enterococci species, such as *E. faecalis*, n= 16; 80% and *E. faecium,* n= 04; 20%, with a considerable proportion from older age groups (≥50 years) (n= 06; 22.2%), females in their gender (n= 14; 21.5%), and rural residents (n= 08; 21.1%), unemployed (n=06; 13.6%), married (n=10; 19.2%), and those earning a monthly income of <3000 Ethiopian birr (n= 12; 34.3%) (Table 1).

A weighty (n= 12; 20.7%) proportion of the study participants practicing vaginal douching/perineal care were acquired Enterococci-caused UTIs. Likewise, un-ignored proportion (n= 07; 21.9%) of the comorbid study participants to either of the chronic diseases: diabetes mellitus, hypertension, renal caliculi, and/or have a previous history of UTIs acquisitions were acquired Enterococci-caused UTIs. Further, a considerable proportion of the study participants receiving antiretroviral drugs containing zidovudine (n= 02; 16.7%), underweight in their nutritional status (n= 03; 27.3%), and had a history of taking anti-tuberculosis drug (n= 17; 41.5%) were acquired Enterococci-caused UTIs. Furthermore, a significant (n= 02; 28.6%) proportion of the study participants who had HIV_RNA greater than or equal to 200 copies per ml were acquired Enterococci-caused UTIs (Table 1).

Factors associated with Enterococci caused UTIs

To assess the association of variables with the occurrence probability of Enterococci-caused UTIs a binary logistic regression analysis model was used**.** Therefore, having a history of taking anti-tuberculosis drugs (COR) =13.69 [(95%CI: 3.67, 51.08)], and earning <3000 Ethiopian birrs per month (COR)= 3.85 [(95%CI: 1.39, 10.63)] were more likely to acquire the Enterococci associated UTIs. Further, after controlling confounding factors under multivariable logistic regression analysis, earning monthly income<3000 Ethiopian birr per month (AOR)= 3.81 [(95%CI: 1.21, 12.05)], and having a history of taking anti-tuberculosis drugs (AOR)= 13.62 [(95%CI: 3.53, 52.63)] were retained its positive association with the occurrence of Enterococci caused UTIs (Table 1).

Table 1: Background, Clinical Characteristics, Proportion of *Enterococcus* caused UTIs and Associated Factors, N= 102

Variables	CPF_UTI N =102	EC_UTIs 20(19.6%)	COR (95%CI)	AOR (95%CI)
Age in completed years				
18-34	12	2(16.7)	0.70(0.12, 4.10)	
35-49	63	12(19.1)	0.82(0.27, 2.48)	
≥ 50	27	6(22.2)	1	
Sex				
Male	37	06(16.2)	0.71(0.25, 2.03)	
Female	65	14(21.5)		
Residence				
Urban	64	12(18.6)	0.87(0.32, 2.36)	
Rural	38	08(21.1)		
Marital status				
Married	52	10(19.2)	0.95(0.36, 2.53)	
Unmarried	50	10(20.0)		
Educational status				
Illiterate	19	3(15.8)	1.06(0.19, 6.05)	
Seco.School	63	14(22.2)	1.62(0.42, 6.33)	
≥ College	20	3(15.0)		
Occupation				
Unemployed	44	06(13.6)	0.51(0.17, 1.42)	
Income per month in Ethiopian birr				
<3000	35	12(34.3)	3.85(1.39, 10.63)*	3.81(1.21, 12.05)*
≥3000	67	8(11.9)		
Nutritional status based on BMI weight for height square				
< 18.5	11	03(27.3)	1.66(0.35, 7.90)	
18.5-24.9	53	10(18.9)	1.03(0.35, 3.00)	
≥ 25.0	38	07(18.4)		
Comorbidity to chronic disease				
Yes	32	7(21.9)	1.23(0.44, 3.45)	
Frequency of vaginal douching/perineal care per day				
≤ 2x	58	12(20.7)	1.17(0.43, 3.18)	
HIV RNA in copies/ml				
≥ 200	07	2(28.6)	1.71(0.31, 9.54)	
Exposure to an ART drug regimen containing zidovudine				
Yes	12	2(16.7)	0.80(0.16, 3.98)	
Exposure to anti-tuberculosis drug				
Yes	41	17(41.5)	13.69(3.67, 51.08) *	13.62(3.53, 52.63) *

Note: CPF_UTI – Culture positive for UTI; EC_UTIs – Enterococci-caused UTI; Sec – secondary which also includes primary school; Unemployed Includes Daily Laborers, House Wife, Students, Retired, farmers, and Merchants; Unmarried Includes Widowed, Single and Divorced; Comorbid includes diabetes mellitus, hypertension, renal caliculi and previous history of UTIs; BMI– Body mass index; * – statistically significant at *P*<0.05.

Prevalence of the bacterial isolates, and their antimicrobial susceptibility profile

This study revealed, among a total of 20 Enterococci bacterial isolates identified in the current study, n= 16; 80%, and n= 04; 20% were E. *faecalis* and *E. faecium* (Table 2, and Figure 1). Further, (n= 02; 12.5%) of the *E. faecalis*, but none of *E. faecium* were isolated from the study participants' comorbid to either of the chronic diseases: diabetes mellitus, hypertension, renal caliculi, and/or have a history of UTIs in their previous life. Almost one fifth (n= 03; 18.8%) of the *E. faecalis*, and one fourth (n= 01; 25.0%) of the *E. faecium* were isolated from the underweight study participants. A significant (n= 11; 68.9%) proportion of the *E. faecalis* and (n= 03; 75%) *E. faecium* were isolated from the study participants practicing vaginal douching/perineal care less frequently per day.

All the *E. faecalis* and *E. faecium* were isolated from the study participants with HIV stage T1. Half (n= 02; 50%) of the *E. faecium*, and over half (n= n= 09; 56.3%) of the *E. faecalis* were isolated from the study participants with higher HIV_RNA levels (≥ 200 copies/ml). Additionally, about two third (n= 10; 62.5%) of the *E. faecalis,* and all the four (100%) *E. faecium* were isolated from the study participants who had exposure to anti-tuberculosis drug.

This study revealed all the isolates of *E. faecium* and *E. faecalis* were resistant to at least 14 different antimicrobials. The majority of *E. faecalis* (93.8%), and *E. faecium* (75%) were resistant to azithromycin while only (37.5%) *E. faecalis* and (25%) *E. faecium* were resistant to nitrofurantoin. However, all the *E. faecium* and *E. faecalis* were susceptible to tetracycline and erythromycin. Further, all the *E. faecium* and *E. faecalis* were multi and extensive drug-resistant. The highest multiple antimicrobial resistance indexes among *E. faecalis* and *E. faecium* were 0.89, and 0.78, respectively (Table 2 and Figure 1).

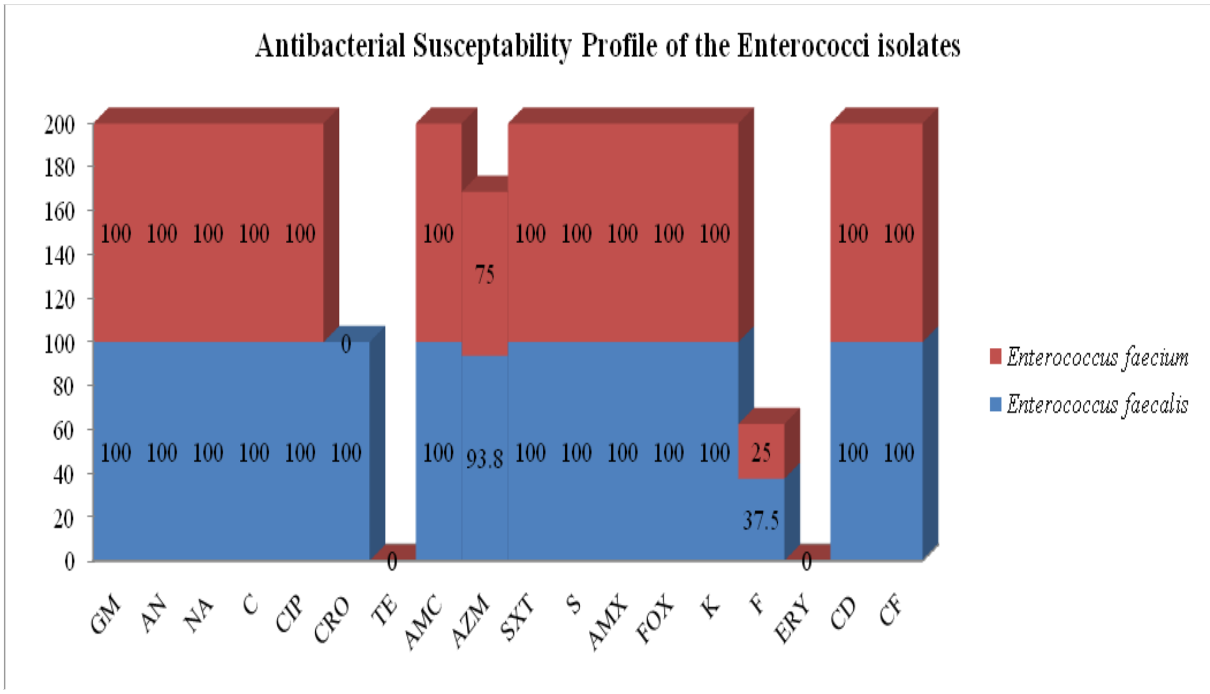

Figure 1: Proportion of Antibacterial Susceptibility Profile of *E. faecium, N= 04,* and E. *faecalis,* N= 16

Table 2: Antibacterial Resistance Pattern of Enterococci, N= 20

BUPT	Resistance Pattern	NoRP	TNatbR	MARI
Enterococcus faecalis	*Gm,Amc,Cro,C,An,Cip,Na,Sxt,Amx,S,Azm,Fox,K,Cf,Cd**	09	15	0.83
	*Gm,Amc,Cro,C,An,Cip,Na,Sxt,Amx,S,Azm,Fox,K,Cf,F,Cd**	06	16	0.89
N = 16	*Gm,Amc,Cro,C,An,Cip,Na,Sxt,Amx,S,Fox,K,Cf,Cd**	01	14	0.78
Enterococcus faecium, No.=04	*Gm,C,An,Cip,Na,Sxt,S,Azm,Amc,Amx,Fox,K,Cf,Cd**	03	14	0.78
	*Gm,C,An,Cip,Na,Sxt,S, Amc,Amx,F,Fox,K,Cf,Cd**	01	14	0.78

Abbreviations: BUTP – Bacterial Uropathogens; NoRP – Number of Resistance Patterns; TNatbR – Total Number of AntimicrobialsResistant; MARI– Multiple AntimicrobialsResistanceIndexes, * – MDR;** – XDR; GM – Gentamycin; AN – Amikacin; NA(Nalidixic Acid); C – Chloramphenicol; CIP – Ciprofloxacin; CRO – Ceftriaxone; TE – Tetracycline; AMC – amoxicillin + Clavulanic Acid or Augmentin; AZM – Azithromycin; SXT – Sulfamethoxazole + Trimethoprim; S – Streptomycin; AMX – Amoxicillin; CD – Clindamycin; F – Nitrofurantoin; K – Kanamycin; Ery – Erythromycin; FOX – Cefoxitin; CF – Cephalothin.

Discussion

This study revealed that one in five, 20 cases (19.6%) of people living with HIV were acquired Enterococci-caused UTIs, with *E. faecalis* (16 cases, 80%) and *E. faecium* (4 cases, 20%). This proportion partly aligns with study findings from Ethiopia, which ranges from 8.85-80.0%[18–20], higher than two study findings from India, Nigeria, and a study from Ethiopia, which ranges from 2.0-15% were associated with Enterococci[21, 39–42]. Further, a study from India reported that 61 out of 115 Enterococci species were *E. faecalis*(53.0%), 42 out of 115Enterococci species were *E. faecium*(36.5%), indicating lower than the prevalence of Enterococci-caused UTIs in the current study [43]. The differences in the prevalence of Enterococci-caused UTIs across these studies may be attributed to variations in study populations' socio-demographic characteristics, geographic locations, or healthcare environments. The higher rate of Enterococci-caused UTIs among this vulnerable population, highlights the importance of close monitoring and management of the infections, focusing on their compromised immunity, which makes them susceptible to opportunistic infections[16].

This study also revealed that earning less income per month and, being exposed to anti-tuberculosis drugs were associated with the occurrence of Enterococci-caused UTIs. The link between low income and occurrence of the Enterococci-caused UTIs could be attributed to factors such as limited access to healthcare, inadequate nutrition, poor living conditions, and lack of sanitation, which increases the risk of acquiring infections, particularly among immune-compromised populations like people living with HIV[27].The positive link between having a history of taking anti-tuberculosis (TB) drugs, and the occurrence of Enterococci-caused UTIs, could be due to the individuals who have been infected with tuberculosis and undergone anti-tuberculosis treatment are more likely to develop Enterococci-caused UTIs, which could be due to the fact that anti-tuberculosis treatment may affect the immune system or alter the microbiota, increases the susceptibility of the individual to opportunistic infections, such as Enterococcus-associated UTIs.

Our study revealed that all the Enterococcus isolates identified by the current study were resistant to at least 14 out of 18 tested antimicrobials, indicating a high rate of antimicrobial resistance among these bacteria. Furthermore, all the Enterococci isolates demonstrated resistance to various classes of antimicrobials, including aminoglycosides, synthetic quinolones, fluoroquinolones, chloramphenicol, iron folate inhibitors, cephalosporins, beta-lactams, beta-lactam inhibitors, and lincosamides. However, all Enterococci isolates were susceptible to erythromycin and tetracycline. The observed high rate of antimicrobial resistance among the isolates, with resistance to numerous antimicrobial classes and susceptibility to only a few, could be attributed to the antimicrobial characteristics of the bacteria. As of acquired antimicrobial resistance, occurs when Enterococci acquire antimicrobial-resistant genes through mutations or horizontal gene transfer, particularly in environments with miss/overuse of heavy antimicrobials[44].The antimicrobial resistance to certain antimicrobial classes explains why Enterococcus species shows a pattern of resistance to many antimicrobial agents while remaining susceptible to only a few, which can complicate treatment strategies and highlight the importance of understanding the bacterial resistance mechanisms to guide effective therapies. Our results show that all the Enterococcus bacterial isolates developed multidrug resistance and extensive drug resistance, indicating a high level of antimicrobial resistance. This finding surpasses the resistance rates reported in a study from Tanzania showed that 56% of Gram-positive bacteria, including Enterococci, developed multidrug resistance-level antimicrobial resistance[17].

Therefore, bearing in mind, the higher prevalence of Enterococci associated UTIs, nature of the bacterial survival capacity in the harsh environment [4, 11, 45], including its antimicrobial characteristics [11, 45], suggested interventions should be implemented are as follows: i) increase awareness of the community about standard infection prevention, and control methods, including the rational use of antimicrobials, this can ultimately decrease the infection, and antimicrobial resistance rate, ii) the policy makers, and the government should integrate UTIs screening program in each visit of PLHIV to health care institutions, and manage accordingly, this can help to identify those asymptomatically acquired the infection, which ultimately decreases related complications, and the spread of antimicrobial resistant pathogens, iii) the health care providers should practice standard diagnostic methods to identify the infection, including the culture and sensitivity method, this can reduce the miss/over use of antimicrobials, which ultimately decreases the spread of antimicrobial resistant microbial, iv) quality of comprehensive HIV care in the ART clinics should be improved, including focusing to opportunistic infections like UTIs, which significantly impacts in reducing the infection rate, and the antimicrobial resistance, v) health care providers should be updated by up-to-date information of the area, through on job training facilitated by the employer, or personal initiatives, vi) the government should expand adequate, and standard diagnostic service centers, which increase access, and utilization rate of the services, this can significantly impacts the reliable diagnosis of the problem, evidence based treatment, this can also ultimately decrease miss/over use of antimicrobials, which result in reducing the development of antimicrobial resistance, and its transmission.

Limitations of the Study

Limitations of this study include a modest sample size from a single geographic area. Findings may not be generalized to other settings.

Conclusions

In conclusion, the study found a higher prevalence Enterococci-caused UTIs, with a high level of antimicrobial resistance among the isolates *E. faecalis*, and *E. faecium*, with predicting factors of low monthly income, and exposure to anti-tuberculosis drugs. Therefore, the finding highlights the need for targeted interventions to manage both the infection rate and antimicrobial resistance among this vulnerable population.

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