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Prevalence of urinary tract infection among students studying Medical Laboratory Science at the University of Jos, Plateau State, Nigeria

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Abstract

Background: Urinary tract infections (UTI) is one of the most commonly reported infections among students in tertiary institutions. This study is designed to determine the prevalence of UTI among students of the Medical Laboratory Science University of Jos, Plateau State.

Materials and Method: In total, 199 mid-stream urine samples were collected from students of Medical Laboratory Science at the University of Jos. The specimens were cultured on CLED agar and Chocolate agar by the standard wire loop method. Bacterial isolates were identified biochemically and antibiotic sensitivity testing was performed using the disc diffusion method. Demographic information was collected by administering a structured questionnaire to the study participants. Data obtained were analyzed by SPSS version 21.

Result: UTI was detected in 9 (nine) out of the 199 (one hundred and ninety-nine) urine specimens analyzed, yielding a prevalence of 4.5%. *E. coli* 5(55.6%) was the predominant bacterial isolate. The highest prevalence of UTI was observed within the age group 15-20 years 2(28.5%) (P=0.017). Also, UTI was more prevalent in females 7 (7.7%) than their male counterparts 2(1.9%). Additionally, UTI was predominant among single students 8 (4.8%), students residing off-campus 8 (5.0%), and students who had no awareness about UTI 1 (5.9%). Besides, UTI was preponderant among 300-level students. Results of the antibiogram indicate that all the bacteria isolated were sensitive to ofloxacin and ciprofloxacin (100%). The least sensitivity (55.6%) was observed in nalidixic acid.

Conclusion: This study revealed a low prevalence of UTI among students of Medical Laboratory Science. The low prevalence may be due to the greater awareness of the student about UTIs as indicated in the study.

Keywords: Urinary tract infection; Midstream urine; Medical Laboratory Science students; Antibiotics

1. Introduction

Urinary tract infection (UTI) is caused by bacterial colonization and invasion of tissues of any part of the urinary tract (kidneys, ureters, bladder, and urethra) (Tanagho and Jack, 2004). The occurrence of UTI is confirmed by the demonstration of a specified count of bacteria in appropriately collected urine from an individual with or without signs and symptoms referable to UTI (Essien *et al.,* 2015).

In healthy persons, most uropathogens originate from rectal or skin flora and enter the urinary tract through the urethra into the bladder. This is known as the ascending route of UTI. Occasionally, bacteria causing UTI may originate from the blood or the lymph and is common in patients with bacteriaemia. However, ascending routes of infection are the most common route of UTI (Handley *et al.,* 2002).

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UTI can be classified based on the part of the urinary tract affected; urethritis (urethra), cystitis (bladder), and pyelonephritis (kidney). The infection of the bladder (cystitis) is the most common form of UTI. Clinically, UTIs can be categorize as either complicated or uncomplicated depending on underlying host factors. In complicated UTIs, the underlying host factors such as age, catheterization, and diabetes mellitus predispose a patient to complicated UTIs, also less virulent uropathogens (that rarely cause disease in a normal urinary tract) can cause significant damage to an abnormal urinary tract. However, uncomplicated UTI refers to the occurrence of bacterial infection in patients with normal structural and functional urinary tract (Nicolle, 2005; Prakash and Saxena, 2013; Sheyin *et al.,* 2016).

The etiology of UTIs has remained constant over the last 2 to 3 decades with *E. coli* accounting for the vast majority of cases. However, the most commonly isolated microorganism in bacterial UTI are the gram-negative bacilli including *Citrobacter spp., Enterobacter aerogenes, Pseudomonas aeruginosa, Proteus spp., Klebsiella spp. and Staphylococcus spp*. (Gupta *et al.,* 2001).

For the past two decades, trimethoprim-sulphamethoxazole (septrin) have been used widely as empirical therapy for *E. coli* UTI. However, the resistance of E coli and other Gram-negative bacteria to septrin in persons with community-acquired UTIs has increased substantially over the past decade and has led to alteration to antibiotic regimens (Gupta *et al.,* 2001).

However, there are many documented studies on the prevalence and antimicrobial profile of UTI among University students and students of other tertiary institutions (Olabimtan *et al.,* 2018; Gebremariam *et al.,* 2019; Iyevhobv *et al.,* 2020; Emeh *et al.,* 2020; Tabassum *et al.,* 2021; Alfa *et al.,* 2022; Saidu and Ologbosere, 2022; Erinle *et al.,* 2022). These studies have helped to create awareness about the occurrence of UTIs and to determine the treatment options for UTIs among students in different localities.

Thus, this study aimed to determine the prevalence and antimicrobial profile of bacterial agents of UTI among students of Medical Laboratory Science at the University of Jos, Plateau State.

2. Material and methods

2.1. Study area/design

The study was a cross-sectional study conducted between September to December 2021. The study was conducted in the Department of Medical Laboratory Science located at the township campus of the University of Jos.

2.2. Study population

The study population comprised of 199 apparently healthy Medical Laboratory Science students who consented to participate in the study.

2.3. Ethical consideration

The ethical approval for this study was granted by the Plateau State Specialist Hospital (PSSH) Jos, Plateau State.

2.4. Data collection

Structured questionnaires were used as a source of data collection and were administered to study participants before sample collection. Information about the age, gender, marital status, place of residence, and awareness about UTI by the students were captured.

2.5. Specimen collection and processing

Clean catch midstream urine specimens were collected into a sterile screw-capped universal container. The specimens were labeled and transported to the departmental laboratory for processing. Urine culture was performed using the standard wire loop method. A loop-full (0.001 ml) of mid-stream urine was inoculated on 10% chocolate agar and cysteine lactose electrolyte deficient (CLED) agar plates. The culture plates were incubated overnight at 37°C under aerobic conditions. Isolates were considered significant if there were $\geq 10^5$ colonies forming per ml of urine (CFU/ml), which translates to pure isolates of not less than 25 to 30 colonies on a culture plate. Mixed growth of organisms was considered as contaminated. Significant isolates were identified by colonial appearance, Gram staining, and biochemical techniques (Essien *et al.,* 2015; Sheyin *et al.,* 2016).

2.6. Antibiotic sensitivity testing

Pure colonies of an overnight culture were suspended in normal saline and adjusted to a turbidity equivalent to 0.5 X MacFarland standard (1.5 x 10^8 CFU/ml) (McFarland, 1907). The suspension was poured onto Mueller-Hinton agar (MHA) (Oxoid, UK) plates and excess fluid was discarded and plates left to air dry. Antibiotic discs were placed on the dried surface and the plates were incubated at 37°Cfor 24 hours.

Antibiotic susceptibility was carried out by the modified Kirby Bauer disc diffusion method (CLSI, 2017). The following antibiotic discs (Oxoid, Basingstoke, UK) were tested on the isolates: penicillin (2 µg), pefloxacin (5 µg), ceporex (30 µg), gentamicin (10 µg), ciprofloxacin (10 µg), augmentin (30 µg), cotrimoxazole (25 µg) nalidixic acid (30 µg), streptomycin (30 µg), ofloxacin (10 µg),). Antibiotic selections for testing and results determination were based on the Clinical Laboratory Standards Institute (CLSI) protocols (CLSI, 2017).

2.7. Data analysis

Data obtained from this study were analyzed using Statistical Package for the Social Sciences (SPSS) version 21.0. Age, gender, marital status, place of residence, class, and awareness of students were compared using Pearson chi-square tests. Results were presented in tables, percentages, and bar charts. P-values of <0.05 were considered statistically significant.

3. Results and discussion

A total of 199 mid-stream urine samples were collected and analyzed for urinary tract infection, out of which 9 (nine) were positive for UTI giving a prevalence of 4.5%. The prevalence of UTI (4.5%) observed in this study was lower compared to the previous study reports; 45.2% by Olabimtan *et al.,* 2018 in a study on UTI among undergraduate students at the Federal University of Agriculture Ogun State; Erinle *et al.,* 2022 reported 36.2% UTI prevalence among undergraduates at the Federal University of Technology in Akure, Ondo State; in Bida, Niger State, Alfa *et al.,* 2022 revealed UTI prevalence of 30% among student of Federal Polytechnic Bida. However, a similar prevalence (10%) was reported in Edo State by Iyevhobu *et al.,* 2020 among students of Ambrose Ali University Ekpoma. However, the low prevalence recorded in this study may be due to the high level of awareness about UTIs by Medial Laboratory Science students as indicated by the respondents.

Table 1 indicates the frequency distribution of bacterial isolates from urine specimens of students studying Medical Laboratory Science at the University of Jos. The result shows that three bacterial species were recovered from the urine specimens. *E. coli* (n=5; 55.6%) was the predominant bacterial isolate, followed by *Klebsiella spp* and *Staphylococcus aureus* (n=2; 22.2%). The preponderant of *E. coli* as an agent of UTI was in consonant with previous related study report conducted elsewhere; in South West Nigeria (Olabimtan *et al.,* 2018; Erinle *et al.,* 2022), in North Central Nigeria (Alfa *et al.,* 2022), in South-South Nigeria (Saidu and Ologbosere, 2022), in Ethiopia (Gebremariam *et al.,* 2019), in Iraq (Al-Hilali, 2018).

Table 1 Distribution of bacteria isolated from urine specimen of students studying Medical Laboratory Science in the University of Jos

Bacterial isolates	Frequency	Percentage
Staphylococcus aureus	2	22.2
Klebsiella spps.	2	22.2
Escherichia coli	5	55.6
Total	9	100.0

Contrary to our finding, Otajevwo and Amedu, 2015 and Ayoade *et al.,* 2013 reported *Staphylococcus aureus* ((33.1%) and *Micrococcus luteus* (40%) respectively as the predominant isolate in a similar study.

The socio-demographic characteristics of students who participated in the study are described in table 2. Regarding the age group of students, this study reveals a high rate of infection among younger students. The age group 15-20 years 2 (28.5%) recorded the highest prevalence of UTI, followed by the age group 21-30 years 6 (4.1%) and 31-40 years 1 (2.3%). However, studies revealing the highest rate of UTI among younger students (15-25 years) have been published (Otajevwo and Amedu, 2015, 70.6%; Olabimtan *et al.,* 2018, 32.3%; Gebremariam *et al.,* 2019, 63.6%; Erinle *et al.,* 2022,

64.4%). Statistically, there was a significant difference when comparing occurrence of UTI among the age group of students (P=0.017; P<0.05). This implies that age group of students was a determinant for the occurrence of UTI.

Table 2 Prevalence of Urinary Tract Infection in relation to socio-demographic characteristics

Demographic variables	No. screened	No. Positive (%)	P-value
Age group			
15-20	7	2 (28.5)	**0.017**
21-30	144	6 (4.1)	
31-40	43	1 (2.3)	
41-50	5	0 (0)	
Gender			
Male	108	2 (1.9)	0.048
Female	91	7 (7.7)	
Marital status			
Single	168	8 (4.8)	0.705
Married	31	1 (3.2)	
Student's accommodation			
Off-campus	160	8 (5.0)	0.512
Hostel	39	1 (2.6)	
Awareness about UTI			
Yes	182	8 (4.4)	0.778
No	17	1 (5.9)	

The prevalence of UTI based on the gender of the student indicates that UTI was higher among female students with 7 (7.7%) compared to their male counterparts with 2 (1.9%). This observation was similar to previous study reports conducted by (Olabimtan *et al.,* 2018; Gebremariam *et al.,* 2019; Iyevhobv *et al.,* 2020; Erinle *et al.,* 2022). In contrast, Otajevwo and Amedu, 2015 reported a higher prevalence (57.1%) of UTI among male students compared to female students (42.9%) in Benin. The reason for the higher prevalence recorded in female students may be due to the difference in the anatomical site. Also, there is a statistically significant difference in the occurrence of UTI among gender (P=0.048; P<0.05).

Concerning the marital status of students, UTI occurred in the majority of the singles 8 (4.8%) when compared to the married 1 (3.2%). Additionally, the marital status of the students was not a determinant factor for the occurrence of UTI (P=0.705; P<0.05).

When considering the prevalence in relation to students' accommodation and awareness about UTI, the highest prevalence was recorded among students who reside off-campus 8 (5.0%) and had no awareness 1 (5.9%) about UTI. Statistically, students' place of residents and awareness had no significant factor to the occurrence of UTI (P=0.512; P=0.778) respectively.

The occurrence of UTI based on the student's level of study is indicated in table 3. The highest occurrence of UTI 3 (6.0%) was recorded among 300 level students, followed by 400 level 4 (5.2%), while the least prevalence 2 (3.7%) occurred among 200 level students. When comparing statistically the prevalence of UTI based on level of study, there was no significant relationship between the level of study and the occurrence of UTI.

Table 3 Prevalence of urinary tract infection according to level of students

Level	No. screened	No. Positive (%)	P-value
200	54	2 (3.7)	0.736
300	50	3 (6.0)	
400	77	4 (5.2)	
500	18	0 (0.0)	
Total	199	9 (4.5)	

The antibiotic sensitivity profile of the nine isolates is presented in figure 1. The rate of sensitivity was highest for ofloxacin and ciprofloxacin (100%). This was followed by ceporex, pefloxacin, gentamicin, augmentin, septrin, and streptomycin (88.9%). However, lower sensitivity was recorded for penicillin (66.7%) and nalidixic acid (55.6%). The 100% sensitivity for ciprofloxacin reported in this study was in tandem with a similar study result conducted by Alfa *et al.,* 2022. Besides, most of the bacterial isolates in the study showed high rate of sensitivity to the different classes of antibiotics used, a similar sensitivity pattern was reported elsewhere (Olabimtan *et al.,* 2018; Iyevhobu *et al.,* 2020; Saidu and Ologbosere, 2022).

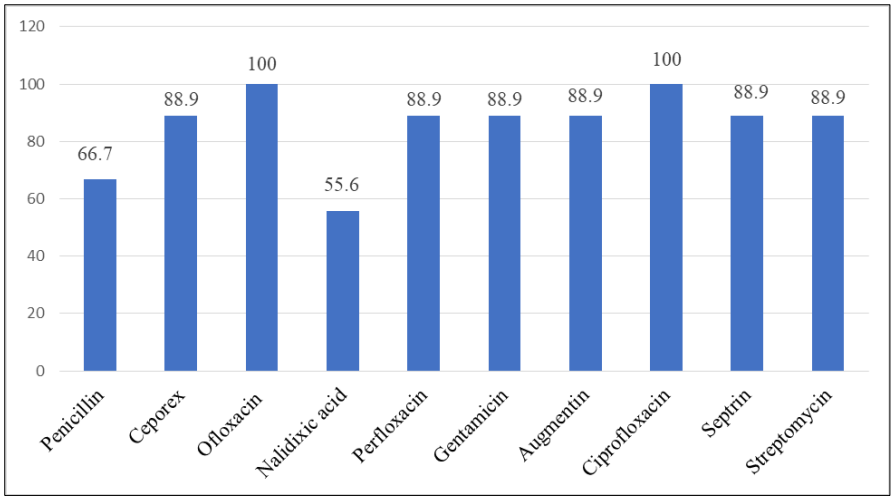

Figure 1 Antibiotic sensitivity pattern of bacteria isolated from urine specimen of Medical Laboratory Science students of the University of Jos (X axis = Percentage of sensitivity, Y axis= Antibiotics)

This implies that the majority of the antibiotics including fluoroquinolones can be used in treating community UTIs among students in the study area.

4. Conclusion

This study reported a 4.5% prevalence of UTI among Medical Laboratory Science students at the University of Jos. However, this value was low compared to previous similar study reports in Nigeria. We attribute this low prevalence to the high level of awareness about UTIs by the student as indicated by the respondents.

Compliance with ethical standards

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Disclosure of conflict of interest

There are no conflicts of interest associated with this work to the best of my knowledge

Statement of ethical approval

The ethical approval for this study was obtained from Plateau State Specialist Hospital, Jos, Plateau State. The statement states that research described has been given approval by the Health Research Ethics Committee.

Statement of informed consent

Informed consent was obtained from all individuals that participated in the study.

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