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Full Length Research Article

# UROPATHOGENS AND THEIR ANTIBIOGRAMS IN ASYMPTOMATIC BACTERIURIA AMONG UNIVERSITY STUDENTS IN ZARIA, NIGERIA

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## ABSTRACT
Invasion of urinary tract by pathogens can lead to urinary tract infections (UTIs). Asymptomatic UTI is characterized by bacteriuria that is not accompanied by typical urinary tract symptoms, which often goes unnoticed until it has become serious. Early detection, accurate diagnosis and appropriate selection of antibiotics can improve prognosis, prevent chonic progression of renal disease and increase treatment success. Students in tertiary institutions may become at risk of UTIs due to overcrowding, poor hygiene practices and sexual activities. This study was focused on assessing the prevalence and antibiograms of uropathogens causing asymptomatic bacteriuria among university students. Mid-stream urine samples of early morning were obtained from 201 students of Ahmadu Bello University, Zaria, Nigeria. Structured questionnaires were administered to the students to collect their socio-demographic information and exposure to certain risk factors. The samples were inoculated onto sterile Xylose Lysine Deoxycholate agar and Centrimide agar plates, incubated at 37°C for 24 h. The pure isolates were identified by cultural morphology, Gram staining and biochemical characterization, and were further challenged with selected antibiotics. Bacterial uropathogens identified were *Citrobacter* spp and *Pseudomonas aeruginosa* with prevalence of 10(5.0%) and 5(2.5%) respectively. The females were more infected than the males. The oldest students of 25-27 years and 28-30 years old had the highest occurrences of *Citrobacter* spp *and Pseudomonas aeruginosa* respectively. All the cases of *Citrobacter* spp were found among single students, but higher occurrence of *Pseudomonas aeruginosa* was found among the married subjects. Students who have spent the longest time (i.e. in their 6th year) in school had the highest infection with the uropathogens. Students that stayed off-campus, share public latrines, drink sachet water and claimed to have one sex partner each were found with higher occurrences of asymptomatic infections. The antibiotic susceptibility test showed that all the isolates were most susceptible to Ciprofloxacin, Ofloxacin, and Pefloxacin, and resistant to Septrin. However, isolates of *Pseudomonas aeruginosa* were resistant to Streptomycin. Students should be well-informed about the risks associated with poor hygiene, over-crowding and unhealthy sexual habits. Routine checkups will help to prevent asymptomatic UTIs from developing into severe infections or complications.

**Keywords:** Asymptomatic, UTIs, bacteriuria, antibiotics, students, susceptibility, uropathogens.

## INTRODUCTION
Urinary tract infections (UTIs) account for a significant portion of bacterial infections acquired in hospitals and communities (Foxman, 2010). Asymptomatic UTI is characterized by bacteriuria that is not accompanied by typical urinary tract symptoms. Such an infection often goes undiscovered until it has become serious. Several assessments of asymptomatic UTI has been focused on children, pregnant and non-pregnant women, the elderly, diabetic patients, individuals with an indwelling urethal catheter, and patients of urologic surgeries or renal organ transplants (Ethel *et al.*, 2006; Cai *et al.*, 2018; Tornic *et al.*, 2020; Wiley *et al.*, 2020). The student population has also been identified as a considerable UTI-risk segment of the society due to some important factors such as sexual activities and improper hygiene practices (Foxman and Chi, 1990; Nicolle, 2008; Vyas *et al.*, 2015; Gebremariam *et al.*, 2019). Some governments around the world have instituted routine checkups on students to ensure their well-being and avoid such illness that disrupts a better learning experience. In Korea, all school children are required by law to have an annual urinalysis since 1998 to ensure early detection and confirmatory diagnosis which was shown to be beneficial for assessing prognosis and assist in preventing progression of chonic renal disease (Cho and Kim, 2007). In Nigeria, there is no such law yet. This study was at aimed at investigating the prevalence and antibiogram of asymptomatic bacteriuria among university students.

## MATERIALS AND METHODS

### Collection of urine samples
A labeled, sterile, screw-capped urine sampling bottles was given to each consented participant with instruction on how to provide 10 mL of early morning, mid-stream of urine sample. A total of two hundred and one (201) samples were collected from both male and female apparently healthy students between the ages 16 to 30 years old in Ahmadu Bello University, Zaria, Kaduna State, Nigeria.

### Culture media and reagents
Xylose Lysine Deoxycholate (XLD) agar and Cetrimide Agar, Simmons citrate agar, Muller-Hinton agar, and Peptone water were purchased from Himedia Laboratories Pvt. Ltd, (Nashik, India). Kovac's reagent, Methyl red indicator, and Voges Proskauer media were all procured from Firmtec Bioscience (Onitsha, Nigeria). Potassium hydroxide (KOH), Barium chloride, and Alpha-Naphthol were purchased from BDH Chemical Ltd (Poole, England). Absolute ethanol was procured from Guangdang Guanghua Chemical Factory Co. Ltd (Shanfua, Guandang China).

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Commercially prepared antibiotics were obtained from Maxicare Medical Laboratory (Makati, Philippines).

**Bacterial isolation**

The urine samples collected were aseptically inoculated onto sterile XLD and Centrimide agar plates prepared according to the instructions of the manufacturers. The inoculated plates were incubated at 37°C for 24 h.

**Colonial morphology and Gram's staining**

The culture plates were examined after 24 h of incubation and bacteriuria was identified as described by Cheesbrough (2005; 2009) . On XLD, suspected *Citrobacter* species appeared as yellow opaque colonies with weak black centers. *Pseudomonas aeruginosa* was identified by the presence of greenish, flat, rough colonies. Pure isolates from XLD and Centrimide agar were Gram-stained. The microscopic characteristics of the isolates such as size, shape, and grouping of cells were also observed. The isolates suspected to be either *Citrobacter* or *Pseudomonas* were subcultured onto freshly prepared Nutrient agar slants for further biochemical identification.

**Indole test**

The test organisms were inoculated onto test tubes containing 10 mL of sterile peptone water and the tubes were incubated at 37°C for 24 h. Three drops of Kovac's indole reagent were added and shaken gently. A positive reaction was indicated by the development of red color in the surface layer within 5 minutes.

**Methyl red and Voges-Proskauer test (MR-VP)**

The test organisms were inoculated in test tubes containing 5 mL of MR-VP and incubated at 37°C for 24-48 h. Next, 2 mL of the broth was transferred onto a small sterile tube and about 2-3 drops of methyl red (indicator) were added. A red color, on the addition of the indicator, signified a positive methyl red test. Five drops of 40% potassium hydroxide (KOH) were added to the remaining broth in the original tube, then followed by the addition of 15 drops of 5% α-Naphthol in ethanol, and the mixture was shaken while the cap of the tube was loosened. The tube was placed in a sloping position. Development of a red color indicated a VP positive test.

**Citrate Utilization Test**

The test organisms were inoculated on Simmon's citrate agar slant in Bijou bottles and incubated at 37°C for 24 h. The development of a deep blue color indicated a positive reaction.
Other biochemical tests were conducted to identify the isolates, which included urease production, oxidase production, motility, lysine decarboxylation (LDC) and ornithine decarboxylation (ODC) tests (Cheesbrough, 2009).

**Antibiotic susceptibility testing**

Turbidity standard equivalent to McFarland's 0.5, which is a barium sulfate standard was compared with the turbidity of each test bacterial inocula (Cheesbrough, 2005). Susceptibility tests were carried out using selected antibiotic discs. Mŭller-Hinton agar prepared according to the manufacturer's instruction was emulsified with test organisms (*Citrobacter* species and *Pseudomonas aeruginosa*) and the discs were placed aseptically and incubated at 37°C for 24 h. After incubation period, the diameter of the zones of inhibition for each antibiotic was measured to the nearest millimeters (mm). The organisms were scored as sensitive or resistant to the drug by comparing the values to the recommended standard chart of Clinical and Laboratory Standard Institute (NCCLS, 2015).

**Statistical analysis**

Data obtained from the study subjects together with the laboratory findings were subjected to Chi-square ($\chi^2$) and Odds ratio (OR) analyses using IBM SPSS version 23 at 95% confidence interval. Final results were simplified and presented tables.

**RESULTS**

Out of a total 201 urine samples examined, 15 samples had asymptomatic bacteriuria. The overall prevalence of *Citrobacter* species was 10(5.0%), while *Pseudomonas aeruginosa* was 5(2.5%) as shown in Table 1.

Table 2 presents the gender-based distribution of the uropathogens. Female students had higher occurrences of *Citrobacter* species (6.9%) and *Pseudomonas aeruginosa* (5.0%) than 3.0% and 0.0% occurrences among the males. However, the gender-based differences in the occurrence of *Citrobacter* spp was not statistically significant (P=0.200), but that of *Pseudomonas aeruginosa* was significant (P<0.024)

Based on age distributions of the uropathogens shown in Table 3, the oldest students of 25-27 years and 28-30 years old had the highest occurrences of *Citrobacter* spp (8.3%) and *Pseudomonas aeruginosa* (20.0%) respectively. Age-based distribution of *Citrobacter* species (P=0.860) was not statistically significant; but the distribution of *Pseudomonas aeruginosa* based on their age groups was significant (P<0.013).

Based on marital status, students who were single had higher occurrence of *Citrobacter* species (5.1%), but absent among those who were married. However, *Pseudomonas aeruginosa* significantly occurred higher among the married students (50.0%) and among those who were single (Table 4).

The distributions of uropathogens in relation to tertiary levels of the students are shown in Table 5. *Citrobacter* species occurred highest among the sixth-year students (22.2%), which was statistically significant (P=0.050). Also, the highest occurrence of *Pseudomonas aeruginosa* was found among sixth-year students (11.1%), but it was not statistically significant (P>0.05).

Table 6 shows the distribution of uropathogens based on the students' exposure to some risk factors. Both *Citrobacter* species and *Pseudomonas aeruginosa* had equally higher occurrences among students that resided off-campus with 5.1% each. However, those that resided within the university hostels were more at risks of asymptomatic bacteriuria (OR>1).

Those who shared public latrines had higher occurrence of *Citrobacter* species (5.2%) more than others who used private latrines (3.6%); but it was not a statistically significant difference, as those with their private latrines were rather more at risk (OR= 1.041). Asymptomatic bacteriuria caused by *Pseudomonas aeruginosa* rather occurred higher among student that used private latrines (7.1%) than among those who shared public latrines. Students who drank sachet water had the highest occurrences of the uropathogens compared to other who drank from other sources

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of water (P>0.05) as shown in Table 6.

Students who claimed to have only one sex partner each were found with the highest occurrence of *Citrobacter* species (12.5%, P=0.171) and *Pseudomonas aeruginosa* (25.5%, P=0.002). Other students who either did not have sex partners, or had more than one sex partner each were found with lower occurrences of the uropathogens (Table 6).

Those students who have had previous history of UTIs were not found with asymptomatic infections caused by *Citrobacter* species, but 6.2% of the infection was recorded among others who have not encountered UTIs before (P>0.05). However, there was equal occurrence of *Pseudomonas aeruginosa* (2.5% each) regardless of having previous UTIs or not (Table 6).
For those students that presented milky-white urine samples, there was highest occurrence of asymptomatic *Citrobacter* species infections among them (7.7%), while *Pseudomonas aeruginosa* occurred only in yellow-orange (or normal) coloured urine samples (3.2%) (Table 6).

Antibiotic susceptibility test revealed that isolates of *Citrobacter* species were 100% susceptible to each of Ciprofloxacin, Pefloxacin and Ofloxacin; followed by 90% susceptibility to each of Sparfloxacin, Augmentin, Gentamincin, Amoxacilin, and Streptomycin. The highest resistance was 20% to Septrin (Table 7).

There was also 100% susceptibility of isolates of *Pseudomonas aeruginosa* to Ciprofloxacin, Pefloxacin and Ofloxacin. The isolates were 100% and 60% resistant to Septrin and Streptomycin respectively (Table 8).

**Table 1**: Overall Prevalence of Symptomatic Uropathogens among Apparently Healthy Students of Ahmadu Bello University, Zaria

| Uropathogens n=201 | Number positive (%) | Number Negative (%) |
|---|---|---|
| *Citrobacter* species | 10(5.0) | 191(95.0) |
| *Pseudomonas aeruginosa* | 5(2.5) | 196(97.5) |

Note: There were no co-infections

**Table 2:** gender-distribution of *Citrobacter* species and *Pseudomonas aeruginosa* among students of Ahmadu Bello University, Zaria

| Gender | Number examined | *Citrobacter* species Number positive (%) | *P. aeruginosa* Number positive (%) |
|---|---|---|---|
| Female | 101 | 7(6.9) | 5(5.0) |
| Male | 100 | 3(3.0) | 0(0.0) |
| | $\chi^2$ | 1.624 | 5.077 |
| | df | 1 | 1 |
| | P-value | 0.200 | 0.024 |
| | OR | 0.415 | 0.950 |

**Table 3**: Age distribution of *Citrobacter* species and *Pseudomonas aeruginosa* among students of Ahmadu Bello University, Zaria

| Age group (Years) | Number of samples examined | *Citrobacter* species Number positive (%) | *P. aeruginosa* Number positive (%) |
|---|---|---|---|
| 16-18 | 20 | 1(5.0) | 2(10.0) |
| 19-21 | 53 | 2(3.8) | 1(1.9) |
| 22-24 | 87 | 4(4.6) | 1(1.1) |
| 25-27 | 36 | 3(8.3) | 0(0.0) |
| 28-30 | 5 | 0(0.0) | 1(20.0) |
| | $\chi^2$ | 1.309 | 12.614 |
| | df | 4 | 4 |
| | P-value | 0.860 | 0.013 |

**Table 4**: Marital status distribution of *Citrobacter* species and *P. aeruginosa* among students of Ahmadu Bello University, Zaria

| Marital status | Number of samples examined | *Citrobacter* species Number positive (%) | *P. aeruginosa* Number positive (%) |
|---|---|---|---|
| Single | 197 | 10(5.1) | 3(1.5) |
| Married | 4 | 0(0.0) | 2(50.0) |
| | $\chi^2$ | 0.214 | 37.981 |
| | df | 1 | 1 |
| | P-value | 0.644 | 0.000 |
| | OR | 1.053 | 0.015 |

**Table 5**: Tertiary level distribution of *Citrobacter* species and *P. aeruginosa* among students of Ahmadu Bello University, Zaria

| Tertiary level | Number examined | *Citrobacter* species Number positive (%) | *P. aeruginosa* Number positive (%) |
|---|---|---|---|
| 100 | 18 | 1(5.6) | 0(0.0) |
| 200 | 22 | 3(13.6) | 2(9.1) |
| 300 | 40 | 1(2.5) | 1(2.5) |
| 400 | 107 | 3(2.8) | 1(0.9) |
| 500 | 5 | 0(0.0) | 0(0.0) |
| 600 | 9 | 2(22.2) | 1(11.1) |
| | $\chi^2$ | 11.014 | 8.365 |
| | df | 5 | 5 |
| | P-value | 0.050 | 0.137 |

**Table 6**: Distribution of *Citrobacter* species and *P. aeruginosa* based on risk factors among students of Ahmadu Bello University, Zaria

| Risk factors | Category | Number examined | *Citrobacter* spp* Number positive (%) | *P. aeruginosa*** Number positive (%) | Statistics $\chi^2$, df, P, OR |
|---|---|---|---|---|---|
| Residence | Hostel | 162 | 8(4.9) | 3(1.9) | *$\chi^2$= 0.002, df=1, P=0.961, OR= 1.041; |
| | Off-campus | 39 | 2(5.1) | 2(5.1) | **$\chi^2$= 1.391, df=1, P=0.238, OR= 2.865 |
| Latrine | Private | 28 | 1(3.6) | 2(7.1) | *$\chi^2$=0.136, df= 1, P= 0.713, OR=1.482; |
| | Public | 173 | 9(5.2) | 3(1.7) | **$\chi^2$=2.906, df=1, P=0.088, OR=0.229 |
| Drinking water | Bottled | 2 | 0(0.0) | 0(0.0) | *$\chi^2$= 0.376, df=3, P= 0.945; |
| | Sachet | 125 | 7(5.6) | 4(3.2) | **$\chi^2$= 0.714, df=3, P= 0.870 |
| | Tap | 73 | 3(4.1) | 1(1.4) | |
| | Well | 1 | 1(0.0) | 0(0.0) | |
| No of Sexual Partners | None | 187 | 8(4.3) | 3(1.6) | *$\chi^2$= 6.411, df=3 P=0.171; |
| | 1 | 8 | 1(12.5) | 2(25.0) | **$\chi^2$=17.469, df=4, P=0.002 |
| | 2 | 1 | 0(0.0) | 0(0.0) | |
| | 3 | 2 | 0(0.0) | 0(0.0) | |
| | ≥4 | 3 | 1(33.3) | 0(0.0) | |
| Previous history of UTI | No | 161 | 10(6.2) | 4(2.5) | *$\chi^2$= 2.615, df=1, P=0.106, OR= 0.938; |
| | Yes | 40 | 0(0.0) | 1(2.5) | **$\chi$2=0.000, df= 1, P=0.995, OR=1.006 |
| Urine colour | Yellow-orange | 158 | 7(4.4) | 5(3.2) | *$\chi^2$= 0.918, df= 3, P= 0.821; |
| | Milky-white | 39 | 3(7.7) | 0(0.0) | **$\chi^2$=1.395, df=3, P= 0.707 |
| | Red-cloudy | 2 | 0(0.0) | 0(0.0) | |
| | Brown-cloudy | 2 | 0(0.0) | 0(0.0) | |

**Table 7**: Antibiotic Susceptibility Pattern of isolates of *Citrobacter* species from Asymptomatic Bacteriuria

| Antibiotics | Disc Potency (µg) | Number of Isolates | Number of Susceptible (%) | Number of Intermediates (%) | Number of Resistance (%) |
|---|---|---|---|---|---|
| SXT | 30 | 10 | 6 (60.0) | 2 (20.0) | 2 (20.0) |
| CH | 30 | 10 | 8 (80.0) | 1 (10.0) | 1 (10.0) |
| SP | 30 | 10 | 9 (90.0) | 1 (10.0) | 0 (0.0) |
| CPX | 10 | 10 | 10 (100.0) | 0 (0.0) | 0 (0.0) |
| AM | 10 | 10 | 9 (90.0) | 0 (0.0) | 1 (10.0) |
| AU | 30 | 10 | 9 (90.0) | 0 (0.0) | 1 (10.0) |
| CN | 10 | 10 | 9 (90.0) | 0 (0.0) | 1 (10.0) |
| PEF | 10 | 10 | 10 (100.0) | 0 (0.0) | 0 (0.0) |
| OFX | 10 | 10 | 10 (100.0) | 0 (0.0) | 0 (0.0) |
| S | 30 | 10 | 9 (90.0) | 0 (0.0) | 1 (10.0) |

**Keys**: SXT= Septrin, CPX= Ciprofloxacin, CN= Gentamycin, AU=Augmentin
CH= Chloramphenicol, AM= Amoxacillin, PEF= Perffloxacin
SP= Sparfloxacin, OFX= Ofloxacin, S= Streptomycin

**Table 8**: Antibiotic Susceptibility Pattern of *Pseudomonas aeruginosa* Isolates from Asymptomatic Bacteriuria

| Antibiotics | Disc Potency (µg) | Number of Isolates | Number of Susceptible (%) | Number of Intermediates (%) | Number of Resistance (%) |
|---|---|---|---|---|---|
| SXT | 30 | 5 | 0 (0.0) | 0 (0.0) | 5 (100.0) |
| CH | 30 | 5 | 1 (20.0) | 2 (40.0) | 2 (40.0) |
| SP | 30 | 5 | 4 (80.0) | 1 (20.0) | 0 (0.0) |
| CPX | 10 | 5 | 5 (100.0) | 0 (0.0) | 0 (0.0) |
| AM | 10 | 5 | 3 (60.0) | 0 (0.0) | 2 (40.0) |
| AU | 30 | 5 | 3 (60.0) | 2 (40.0) | 0 (0.0) |
| CN | 10 | 5 | 3 (60.0) | 2 (40.0) | 0 (0.0) |
| PEF | 10 | 5 | 5 (100.0) | 0 (0.0) | 0 (0.0) |
| OFX | 10 | 5 | 5 (100.0) | 0 (0.0) | 0 (0.0) |
| S | 30 | 5 | 0 (0.0) | 2 (40.0) | 3 (60.0) |

**Keys**: SXT= Septrin, CPX= Ciprofloxacin, CN= Gentamycin, AU=Augmentin,
CH= Chloramphenicol, AM= Amoxacillin, PEF= Perffloxacin,
SP= Sparfloxacin , OFX= Ofloxacin, S= Streptomycin

**DISCUSSION**

Due to factors such as sexual activity and lack of maintenance of hygiene standards, the university student population is considered as a UTI-risk segment of society. The results of the present study suggest that prevalence of asymptomatic uropathogens among students in Ahmadu Bello University, Zaria, Nigeria is low. Nevertheless, to ensure that UTIs do not become an expanding problem, routine student checkups are recommended. Such an approach can be complemented by creation of awareness about UTIs and their preventive measures, appropriate diagnosis and antibiotic susceptibility-guided choices of antibiotics and their controlled use.

Female students had comparatively higher occurrences of asymptomatic infections caused by *Citrobacter* species and *Pseudomonas aeruginosa* than male students. Generally, the susceptibility of females to urinary bacterial invasion and colonization had been attributed to the nature of the female genitalia and urethal openings, resulting in a higher incidence of urinary complaints and bacterial isolation from their urine samples (Seifu and Gebissa, 2018; Barwa *et al.*, 2022). Female urethal and vaginal openings are significantly less effective in preventing bacterial entry due to their location and anatomy (Bishop and Shehu, 2016; Seifu and Gebissa, 2018). Just wiping the anus in an unsanitary manner from back to front aids in the inoculation of the vulva and vagina with faecal-borne pathogens (Bishop and Shehu, 2016), which successful colonization may subsequently become uropathogens.

Older students between the ages of 25-27 and 28-30 years old, as well as those in their sixth year at the university particularly carry greater burdens of the asymptomatic urinary infections. It suggests that older students and those running long duration courses may be prone to asymptomatic UTIs, which may be due to likely sexual activities among them. Sharing of latrines in public places can predispose one to urinary tract infections. This could be due to high frequency of daily use of public latrines, with little or no maximum routine cleaning/disinfection. Barwa *et al.* (2022) observed that overcrowding in hostels can cause general lack of adequate hygiene in latrines shared by tertiary students. Hence, those who use public latrines can easily contract urinary tract infections than others who shuttle from their homes or have private latrines.

*Citrobacter* species are Gram-negative, non-lactose fermenting rods that are often found among the human microbiota. However, they are frequently a source of serious opportunistic infection, with the urinary system being one of the most prevalent sites of its infection (Stewart *et al.*, 2017). *Citrobacter* spp as the cause UTIs had been isolated from urine in many studies (Metri *et al.*, 2013; Ranjan and Ranjan, 2013; Bishop *et al.*, 2016), corroborating the finding in this study.

Due to their increasing proclivity in causing not just nosocomial infections but also community-acquired infections, *Citrobacter* spp may pose a serious challenge in healthcare (Sami *et al.*, 2017). Previous reports had shown that *Citrobacter* spp is the third most common cause of UTIs in hospitalized patients after *Escherichia coli* and *Klebsiella* species (Metri *et al.*, 2013). *Pseudomonas aeruginosa* is the most widely environmentally-dispersed opportunistic bacteria. Incidentally, *Pseudomonas aeruginosa* has become one of the most prevalent sources of hospital-acquired UTIs (Lamas-Ferreiro *et al.*, 2017) with a high incidence of antibiotic resistance (Newman *et al.*, 2017).

A good number of antibiotics used in this study, such as Ciprofloxacin, Ofloxacin, and Pefloxacin, appeared promising against *Citrobacter* spp and *Pseudomonas aeruginosa,* although some reports had suggested rising concerns due to the reduced activity of Ciprofloxacin (Grillon *et al.*, 2016) which experts have warned earlier that extensive use of Ciprofloxacin could lead to increased resistance (Mehnert-Kay, 2005). In agreement with our findings, Septrin resistance in UTIs has been reported ( Wright *et al.*, 1999; Guneysel *et al.*, 2009; Barwa *et al.*, 2022). Also, streptomycin, for a long time has been shown to be inactive on *Pseudomonas aeruginosa* (Cervantes-Vega *et al.*, 1986) leading to its diminished use in clinics (Sundin and Bender, 1996; Khan *et al.*, 2020). This study adds to the increasing evidence of the role of Gram-negative bacteria in asymptomatic UTIs.

**Conclusion**

This study revealed the occurrence of asymptomatic bacteriuria among university students, with prevalence of 5.0% and 2.5% for *Citrobacter* species and *Pseudomonas aeruginosa* respectively.

The female students were more prone to the infections. Asymptomatic urinary tract infections were more frequent among older study subjects, those in their sixth-year, who resided within school hostels and share public latrines. The uropathogens were highly susceptible to Ciprofloxacin, Ofloxacin, and Pefloxacin, but resistant Septrin. It is important that students be given proper orientation on UTIs and preventive measures, and be advised to go for routine UTIs screening in order to be given antibiotic susceptibility-guided treatment.

**Conflict of interest**
The authors have no conflicts of interest to declare.

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