Prevalence of Asymptomatic Bacteriuria among Female University Students

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ABSTRACT

Background: Asymptomatic Urinary Tract Infections (AUTI) are common in apparently healthy populations and are detectable in the laboratory as 'significant bacteriuria'. Therefore, this study aimed to assess the asymptomatic bacteriuria among the university students and to examine the student's practices and risk factors that contribute with the occurrence of asymptomatic bacteriuria.

Methods: This descriptive cross-sectional study included 184 student selected by stratified random sampling technique. Data were collected using self-administered online questionnaires that included a personal data, history of UTI, health-related hygienic practices and dietary preference has and habits. Urine investigation was done for the participated students. Descriptive statistics, cross-tabulation were used for data analysis.

Results: The finding shows that nearly one-third of the study participants reported had a previous history of urinary tract infection. The most repeated complaint was urgency (31%) and side pain (26.6%). Results revealed that (40.2%) were positive for significant bacteriuria. There was a negative association in the prevalence of asymptomatic bacteriuria with respect to age. (40.2%). Escherichia coli was the most predominant organism followed closely by Staphylococcus aureus. Ciprofloxacin to be the most effective antibiotic followed by Amikacin and Nitrofurantoin. Ampicillin, Cloxacillin and Erythromycin were highly resistant to the isolates.

Conclusions: The results of this study emphasize the importance of raising students' awareness and habitual practices as a primary prevention of the urinary tract infection. Routine urine culture test should be carried out periodically to early detect asymptomatic bacteriuria.

Keywords: Asymptomatic bacteriuria, University students, Eating habits, Ciprofloxacin

INTRODUCTION

Urinary Tract Infection (UTI) is one of the most important causes of morbidity in the general population and is the second most common cause of hospital visits [1]. "Asymptomatic bacteriuria," or asymptomatic urinary infection, is isolation of a specified quantitative count of bacteria in an appropriately collected urine specimen obtained from a person without symptoms or signs referable to urinary infection [2]. "Acute uncomplicated urinary tract infection" is a symptomatic bladder infection characterized by frequency, urgency, dysuria or suprapubic pain in a woman with a normal genitourinary tract and it is associated with both genetic and behavioral determinants. Screening of asymptomatic subjects for bacteriuria is appropriate if bacteriuria has adverse outcomes that can be prevented by antimicrobial therapy [3]. Outcomes of interest are short term, such as symptomatic urinary infection (including

bacteremia with sepsis or worsening functional status) and longer term, such as progression to chronic kidney disease or hypertension, development of urinary tract cancer or decreased duration of survival [4].

Asymptomatic Urinary Tract Infections (AUTI) is common in apparently healthy populations and is detectable in the laboratory as 'significant bacteriuria' [5]. When a person has no symptoms of infection but significant numbers of bacteria have colonized the urinary tract, the condition is called AUTI, also called Asymptomatic Bacteriuria (ASBU) [6]. AUTI is defined as the presence in the urine of more than 105 colony-forming units of organisms per ml of urine in the absence of symptoms referable to the urinary tract [7].

UTI among university students is commonly similar to the general population and the majority of the females have recurrent infections within 1 year [8]. The prevalence of UTI in Saudi Arabia among college students was found to be 32.1% [9].

The prevalence asymptomatic bacteriuria in populations varies widefly with age, gender and the presence of genitourinary abnormalities. For healthy women, the prevalence of bacteriuria increases with advancing age, from ~1% among school girls to 120% among healthy women 80 years of age living in the community [10].

Females far exceed males in the prevalence of ASBU because of the relative proximity of the anus to the vaginal introitus, the latter is susceptible to colonization with enteric bacteria. Additionally, factors reported facilitating introital colonization include a relatively high pH of vaginal secretions (more than 4.4), the presence of vaginal epithelial cell receptors that might aid bacterial adherence and decrease the production of specific cervicovaginal antibody [11].

Both asymptomatic and symptomatic UTIs pose a serious threat to public health care, hence reducing the quality of life and resulting in work absenteeism [12]. The symptoms of UTIs such as fever, burning sensations while urinating, lower abdominal pain, itching, the formation of blisters and ulcers in the genital area, genital and suprapubic pain and pyuria generally depend on the age of the person infected and the location of the urinary tract infected. Patients with asymptomatic UTI should demonstrate both pyuria and bacteriuria. Pyuria, which indicates an inflammatory reaction in the urinary tract, is generally defined as a positive leukocyte esterase on urine dipstick or ≥ 10 white blood cells per high-powered field (WBCs/HPF) on urine microscopy, a threshold selected to offer a high negative predictive value for urine culture positivity and clinical UTI.

The diagnosis of UTI requires three components; clinical symptoms of infection localizing to the urinary tract or nonspecific symptoms of infection in the absence of symptoms suggesting infection elsewhere, laboratory evidence of pyuria and bacteriuria. The absence of another infection or non-infectious process to which the patient's symptoms can be readily attributed [13].

Patients with positive urine cultures who lack symptoms of a UTI have the diagnosis of ASBU. There are few strategies in which antibiotic treatment of asymptomatic bacteriuria has been shown to improve patient outcomes. Because of increasing antimicrobial resistance, it is important not to treat patients with ASBU unless there is evidence of potential benefit [14].

Therefore, the aim of this study is to assess the prevalence of bacteriuria, risk factors, bacteriological profile, habitual practices among female medical sciences college, Hafr Al Batin University, Saudi Arabia.

MATERIALS AND METHODS

Study Design

Descriptive cross-sectional study design was conducted across medical sciences college, Hafr Al Batin University, Saudi Arabia between February 2019 until May 2019.

Study Setting, Sampling and Population

Stratified random sample technique was followed to select study participants. The total number of enrolled students for the academic year 2018-2019 was 336 represents both nursing and clinical laboratory students. Generally, the response rate of a questionnaire invitation was approximately 55.4%. All-female students at different study levels, non-menstruated at the time of urine sample collection were included.

Study Questionnaire and Data Collection

Two tools were used for data collection.

Tool one: Researchers developed an online questionnaire after in-depth reviewing of the related literature. The content validity of the form was assessed by an expert panel of three independent academicians from the nursing and clinical laboratory departments (one associate professor in community health nursing and one assistant professor in medical surgical nursing a one assistant professor in clinical microbiology). A pilot study was carried out on 10% of the sample, to evaluate the applicability of the tool and excluded from the main study sample. The questionnaire include questions about socio-demographic characteristics such as (age, marital status, grade), past history of UTI, present complaints of UTI, health-related hygienic practices such as (the technique of perineal care, use of the cotton pad, prays, deodorant or oils, fluid and food habit), dietary preferences and habits.

Tool two: Urine investigation was done through three steps:

- Microscope examination at high magnification for pus cells, red blood cells, epithelial cells, casts, crystals, yeast-like cells and Trichomonas vaginalis. Pus cells >5 per high power field were also considered significant for infection.

- **Isolation and identification of the bacterial uropathogens:** Each sample of the uncentrifuged, uniformly mixed samples were inoculated on Cystine Lactose Electrolyte Deficient agar (CLED) and incubated at 37°C aerobically for 24 hrs. After incubation, the cultures were subcultured on MacConkey agar and sheep Blood Agar (BA) media, observed and recorded. Positive UTI was recorded after having the presence of 100,000 Colony-Forming Units (CFU) per milliliter in the culture. The isolates observed on the selective media were preserved in 40% glycerol at -80°C.

- Antibiotic sensitivity test was carried out to determine the antibiotic susceptibility pattern of the different isolates.

   The students were informed that an online questionnaire will be sent to them asking participation in the study. The participant's submission of the completed questionnaire was considered as their agreement to participate in the study. All participated students were announced about the time for urine analysis sample. Before the collection of student's urine samples, they instructed about the correct technique for bringing a sample and then they asked to bring a sample of midstream urine in the morning. After that, all specimens were labeled the urine analyses of the samples. All questionnaire answers were revised, coded and entered to Statistical Package for Social Sciences (SPSS version 23) program. Descriptive statistics were calculated. The concluded data were categorized, tabulated and analyzed using frequency distribution, percentage and cross tabulation.

Ethical Statement

A letter with the research proposal and instruments was presented to the dean of the college to gain an approval to conduct the study. After gaining the college agreement to conduct the study, researchers visited the classrooms before every scheduled lectures to explain the purpose of the study to all students and they were informed that their identities would be kept confidential and their participation would not affect their grades in any way and they have the right to withdraw from the study at any time.

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RESULTS

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Respondents' Characteristics

The socio-demographic characteristics of the study sample. It was observed that the mean students age was (20.56 years ± 1.36) years). The vast majority (90.2%) were single and nearly one-third (35.3%) of them represent grade one followed by grade four (28.3%) (Table 1).

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Table 1 Socio-demographic characteristics of the medical sciences college students, Hafr Albatin, SA, 2019

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Socio-demographic data	No. (184)	%
Age		
16-20	103	56
21-25	81	44
Mean age ± SD = 20.56 ± 1.36		
Marital status		
Married	18	9.8
Single	166	90.2
College year		
First year	65	35.3
Second year	50	27.2
Third year	17	9.2
Fourth year	52	28.3

Respondent's Medical History and Complaints

The history of chronic illness, present complaint with AUTI are described. The majority of students (92.4%) had no chronic illness and (16.8%) reported taken antibiotics without prescription. Nearly two-thirds (67.9) reported had no previous complaints of UTIs. Additionally, (96.2) reported complaint from urine spots, most of them (98.4%) had dark urine, urgency (31%), side pain (26.6%) and lower abdominal pain (21.2%) (Table 2).

Table 2 Chronic illness and present UTIs complaints among medical sciences college students, Hafr Albatin, SA, 2019

History	No. (184)			
	Yes		**No**	
	No.	**%**	**No.**	**%**
Do you have any chronic illness?	14	7.6	170	92.4
Do you take any medication?	25	13.6	159	86.4
Do you use antibiotics without a prescription?	31	16.8	153	83.2
Do you previously complain from UTIs?	59	32.1	125	67.9
Do you have any of the following complaints?				
Urgency	57	31	127	69
Fever	8	4.3	176	95.7
Lower abdominal pain	39	21.2	145	78.8
Bad odor	21	11.4	163	88.6
Side pain	49	26.6	135	73.4
Urine spots	7	3.8	177	96.2
Dark urine	3	1.6	181	98.4

Health-Related Hygiene Practices

The students practices relate to perineum hygiene is illustrated. More than three quarters (88.6%) reported go to the toilet when feel the urgency, two thirds (66.8%) reported drying perineal area from up to down, (16.8%) reported wear nylon made underwear. Also, (84.2%) of them reported used oils or liquid soap during bathing (Table 3).

Table 3 Health-related hygiene practices of the medical sciences college students with asymptomatic UTI, Hafr Albatin, SA, 2019

No. (184)				
Item	**Yes**		**No**	
	No.	**%**	**No.**	**%**
Do you wash the perineal area?	175	95.1	9	4.9
Do you start perineal drying from up to down?	123	66.8	61	33.2
Do you go to the toilet when you feel the urgency?	163	88.6	21	11.4
Do you wear nylon made underwear?	31	16.8	153	83.2
Do you use a cotton pad?	157	85.3	27	14.7
Do you use sprays or deodorant (mesk, powder)	22	12	162	88
Do you use oils or liquid soap during bathing?	155	84.2	29	15.8

Eating Preferences

The results shows that two-third (76.6%) of students reported preferring eating high acidic food (lemon, oranges and chocolates) and (63.3% and 47.8%) of them like to drink a lot of coffee/tea and soft drinks respectively. Additionally, more than half (58.7% and 54.9%) of students reported preferring spicy foods and salty foods respectively (Table 4).

Table 4 Health-related eating habits of the medical sciences college students with asymptomatic UTI, Hafr Albatin, SA, 2019

Item	No. (184)			
	Yes		**No**	
	No.	**%**	**No.**	**%**
Do you drink a lot of fluids a day?	86	46.7	98	53.3
Do you drink a lot of coffee/tea a day?	117	63.3	67	36.4
Do you prefer to soft drink?	88	47.8	96	52.2
Do you prefer to eat high acidic food (lemon, oranges and chocolates)?	141	76.6	43	23.4
Do you prefer spicy foods?	108	58.7	76	41.3
Do you prefer salty foods?	101	54.9	83	45.1

## Prevalence of Asymptomatic Urinary Tract Infection by Age

Urine samples cultures shows that out of one hundred eighty-four urine samples collected, 74 (40.2%) were culture positive on CLED. ASBU represents (51.5%) among students aged 16 years-20 years old and (25.9%) among 21 years-25 years old. This mean that the prevalence decreases with advancing age (Table 5).

Table 5 Prevalence of asymptomatic bacteriuria with regard to age among the medical sciences college students, Hafr Albatin, SA, 2019

Age group	Number of examined samples	Number of positive culture	%[*] Positive culture
16-20	103	53	51.45
21-25	81	21	25.93
Total	184	74	40.2

Bacteriological Profile

E. coli was the most prevalent bacterial uropathogen isolates which represents (41.4%), while *S. aureus* represents (24.3%) and the lowest was *Pseudomonas aeruginosae* (7.14%) (Figure 1).
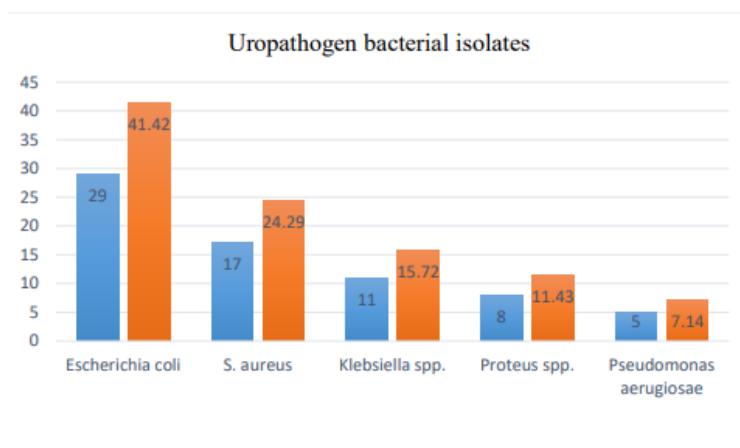
Figure 1 Frequency of bacterial uropathogen isolates among medical sciences college students with asymptomatic UTI, Hafr Albatin, SA, 2019 Note: No.   %

As regard to distribution of antimicrobial-resistant pattern of bacterial strains, the results revealed that ciprofloxacin was the most effective antibiotic followed by amikacin and nitrofurantoin. Ceftriaxone and nalidixic acid were moderately effective against the uropathogenic strains. ampicillin, cloxacillin and erythromycin were highly resistant to the isolates (Table 6).

Table 6 Antimicrobial-resistant pattern of bacterial strains isolates among medical sciences college students with asymptomatic UTI, Hafr Albatin, SA, 2019

Antibiotic										
Bacterial strain		**AMP**	**AMC**	**GEN**	**AUG**	**CLX**	**CRO**	**CIP**	**F**	**ERY**
Escherichia coli	29	29	17.24	10	10	15	20	4	5	22
		-100	-5	34.48	-34.48	-51.72	-68.97	-13.79	-17.24	-75.86
S. aureus	17	9	2	11	11	9	9	1	0	9
		-52.94	-11.76	-64.7	-64.7	-52.94	-52.94	-5.88	0	-52.94
.Klebsiella spp	11	7	0	4	9	6	7	3	2	4
		-63.63	0	-36.36	-81.81	-54.54	-63.63	-27.27	-18.18	-36.36
.Proteus spp	8	6	0	3	4	2	5	0	1	4
		-75	0	-37.5	-50	-25	-62.5	0	-12.5	-50
Pseudomonas aerugiosae	5	4	3	1	0	3	4	1	1	3
		-80	-60	-20	0	-60	-80	-20	-20	-60

DISCUSSION

The present study conducted on Applied Medical Sciences College (nursing and clinical laboratory sciences) students as preventive step and early detection of cases at risk. In addition, they are often the primary caregivers who

can demonstrate the role of health educator and mentor through proper approaches in identifying and resolving women issues, particularly in a country like Saudi Arabia, where such issues are considered strictly private [15].

UTI is the typical type of infectious disease, which can occur for all groups of populations. However, some particular groups of people are more prone to UTI than others, such as females are at a higher risk compared to males due to their shorter urethra, which is continually contaminated with pathogens from the vagina and rectum.

The present study findings show that the mean of the participant's age was 20.56 ± 1.36 and the majority of them were single. The majority of the respondents were between 18 years-20 years. It also, founded that half of them were single. In the present study, most of the symptoms noticed in the majority of the students had (side pain and urgency) [16,17]. The near to half of the participants had nocturnal, frequent urination, back pain and burning sensation. Results showing that the higher percentage concerning health-related hygiene practices followed by students, the majority of them washes perineal area, used liquid soap and oils, wear a cotton pad and go to the bathroom when they feel urgency. This finding was agreed with Bokolia who reported that near to half of the total assessed population wash their vagina after urination and change the sanitary pads. Regarding the dietary habits and preferences, the study noticed that a sizable proportion of more than half of students did not drink a lot of fluids and daily drink cola, a lot of tea and coffee, prefer spicy and salty foods respectively. On the other hand, the majority of them prefer to eat acidic food. The current finding is relatively consistent with the study observed that the near to half of the participants drink lots of water. Additionally, half of the participants avoid drink acidity juice and this contradicts the current study [18]. The current study revealed that the students with positive urine cultures who lack symptoms of a UTI have the diagnosis of asymptomatic bacteriuria. Out of one hundred eighty-four urine samples collected, 74 were culture positive on CLED. ASBU is more common in some student populations and the prevalence decreases with advancing age. This finding is in agreement with the study conducted by, who demonstrated that age ≤ 19 years, female gender was founded to bear a statistically significant relationship with asymptomatic UTIs. Age and female gender were found to have a statistically significant relationship with UTIs. Additionally, several recent genomic sequencing-based studies of human urine demonstrate that the urinary tract is not sterile even when urine cultures are negative; instead, the healthy urinary tract is host to a unique community of bacteria and viruses. The current study revealed that *E. coli* as the most prevalent bacterial uropathogen (41.42%), while Pseudomonasaeruginosae was (7.14%). This finding is comparable with another study finding which indicated that 40%-46% of isolation was *E. coli* [19].

The high prevalence of *E. coli* in the female gender could be due to the proximity of the anus to the vagina. This high possibility of UTIs in females is due to the inherent virulence of *E. coli* for urinary tract colonization such as its abilities to adhere to the urinary tract and association with other microorganisms moving from the perineum areas contaminated with fecal microbes to the moist warm environment of the female genitalia. *Staphylococcus aureus* was the second most isolated bacterial uropathogen with (24.29%) of frequency. The high frequency of *S. aureus* in UTI is not unique to this study. Earlier studies reported high rates of *S. aureus* isolated from asymptomatic UTI samples. The other organisms isolated included Klebsiella species, Proteus species and *Pseudomonas aeruginosa*. They are less common organisms causing UTI. The very low growth of *Pseudomonas spp.* could be attributed to the fact that all these cases were from female students (outpatients) *Pseudomonas spp.* is more commonly acquired as a nosocomial infection. Increase in urinary progestin and estrogens may lead to decreased ability of the lower urinary tract to resist invading bacteria beside decreased urethral tone that possibly allows some strains of bacteria to selectively grow. Concerning antibiotic susceptibility of the isolated pathogens involved in the current study, the study revealed that Ciprofloxacin to be the most effective antibiotic followed by amikacin and nitrofurantoin. Ceftriaxone was moderately effective against the uropathogenic strains. Ampicillin, cloxacillin and erythromycin were highly resistant to the isolates. The upsurge in the antibiotic-resistant pattern seen in this study could be due to antibiotic abuse and self-medication being practiced in many developing countries. Additionally, the availability of these drugs could be another contributing factor for antibiotic resistance. The high consumption of antibiotics in the community can be a cause of a major problem in treatment. Infections with multidrug-resistant bacteria lead to high costs for the patients. Because of the decrease in the susceptibility of pathogens to the antibiotic [20].

CONCLUSION

In the present study, the overall prevalence of UTI was 40.2%. Cross tabulation results reveals that positive bacteriuria results was more apparent among students aged 16 years-20 years old and become less by advancing in

age. About one third of the respondents had a previous history of UTI, the results revealed that ciprofloxacin was the most effective antibiotic followed by amikacin and nitrofurantoin. Ceftriaxone and nalidixic acid were moderately effective against the uropathogenic strains. Ampicillin, cloxacillin and erythromycin were highly resistant to the isolates. Therefore, from this study, there is a significant increase in UTI and antibiotic resistance in university students. Routine urine culture test should be carried out periodically to early detect asymptomatic bacteriuria. Designing and implementing an education programs about proper hygienic practices, healthy eating habits would be of great importance to increase students' awareness and prevention of UTI. In addition, students should be guided about the consumption of antibiotics without prescription to prevent the spread of resistant bacteria. Many issues relevant to asymptomatic bacteriuria require further research and evaluation in appropriately conducted clinical trials.

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DECLARATIONS

Conflicts of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

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