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Prevalence of Asymptomatic Bacteriuria in School Aged Children: A Screening Study

Sarah Sabah Hasan Alshami
Family Medicine Specialist, C.A.B.S. (Family Medicine), Ministry of Health- Karbala Health Directorate, Iraq

Nidhal Awad Obaid Alibraheemi
Family Medicine Specialist, C.A.B.S. (Family Medicine), Ministry of Health- Karbala Health Directorate, Iraq

Mohanad Qasim Mahfoodh Abdullah
Family Medicine Specialist, C.A.B.S. (Family Medicine), Ministry of Health- Karbala Health Directorate, Iraq

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Abstract: Background: Asymptomatic bacteriuria (ASB) is a common but often missed condition in school-aged children affected children remain asymptomatic, persistent bacteriuria may predispose high-risk groups to recurrent urinary tract infections and renal complications and the data regarding the prevalence and associated factors of ASB among Iraqi school-aged children are limited.

Aim of the study: To determine the prevalence of asymptomatic bacteriuria among school-aged children and to identify factors associated with its occurrence.

Patients and methods: Prospective cross-sectional screening study was conducted at Karbala Health Directorate primary health care centers from July to December 2025 and included total of 194 school-aged children (6–14 years) attending the primary care. Children with urinary symptoms, recent antibiotic use, or known urinary tract abnormalities were excluded. Data were collected using a questionnaire that included clinical assessment, urinalysis, urine culture, and relevant laboratory investigations. Asymptomatic bacteriuria was defined as significant bacterial growth on urine culture in the absence of urinary symptoms.

Results: The prevalence of asymptomatic bacteriuria was 6.7% (13/194). Escherichia coli was the most commonly isolated organism (62%), followed by Klebsiella, Proteus, and Enterococcus species. Pus cells, positive nitrite test, and bacteriuria on microscopy were significantly more common among children with ASB ($p<0.05$). Female gender, low daily water intake, and infrequent sanitary pad changes among menstruating girls were significantly associated with ASB. No significant differences were seen between ASB-positive and ASB-negative children regarding hemoglobin level, white blood cell count, serum creatinine, or blood urea. Nitrofurantoin showed the highest antimicrobial sensitivity among isolated organisms.

Conclusions: Asymptomatic bacteriuria is relatively common among school-aged children, particularly girls. Escherichia coli is the predominant causative organism. ASB is associated with modifiable factors such as inadequate hydration and poor menstrual hygiene.

Recommendations: Consider targeted screening of high-risk groups, especially school-aged girls. Health education programs should focus on adequate water intake and proper menstrual hygiene for girls.

Keywords: Asymptomatic bacteriuria, School-aged children, Urinary tract infection, Prevalence, Risk factors.

Introduction: Urinary tract infections (UTIs) are among the most common bacterial infections in children and can affect both the bladder and kidneys. (1)

School-aged children with lower UTI often present with localized symptoms such as dysuria and urinary frequency, while younger children may show nonspecific symptoms like fever or irritability. In addition to dysuria and urinary frequency, school-aged children with lower UTI may also present with suprapubic or lower abdominal pain, urinary urgency, hesitancy, and daytime urinary incontinence or secondary enuresis. Some children may report foul-smelling or cloudy urine and, less commonly, visible hematuria. In contrast, younger children and infants often exhibit nonspecific manifestations, including poor feeding, vomiting, lethargy, failure to thrive, and unexplained fever or irritability, which can make the diagnosis less straightforward. (2)

Girls are generally more affected than boys due to anatomical and hygiene-related factors. (3)

Asymptomatic bacteriuria (ASB) is defined as the presence of significant bacterial growth in urine without any symptoms of urinary tract infection. It is often discovered incidentally during screening or routine testing because children do not experience pain, fever, or urinary complaints. (4)

The main difference between ASB and symptomatic UTI is the presence of clinical symptoms. Symptomatic UTI causes inflammation and produces signs such as dysuria, urgency, and abdominal pain. (5)

In contrast, ASB does not cause symptoms because the bacteria colonize the urinary tract without triggering an inflammatory response. This difference is important because symptomatic UTIs require treatment, while ASB in healthy children usually does not need antibiotics. (6)

Urinary tract infections in children are a significant cause of morbidity, and their early detection is crucial to prevent complications. Although symptomatic UTIs are often recognized and treated promptly, while asymptomatic bacteriuria (ASB) may remain undetected for long periods. Persistent ASB, particularly in children with underlying structural or functional urinary tract abnormalities, can increase the risk of renal scarring and long-term kidney damage. (7)

The pathogenesis of ASB involves bacterial colonization without eliciting noticeable clinical symptoms. Common pathogens include Escherichia coli, Klebsiella, and Proteus species. (8)

Factors such as (female gender, poor hygiene, incomplete bladder emptying, and socioeconomic conditions) can predispose children to ASB. Understanding these factors and the silent nature of ASB underscores the importance of epidemiological studies to determine prevalence, identify high-risk groups, and guide preventive pediatric healthcare strategies. (9)

Early identification of ASB is essential because children with undiagnosed bacteriuria may develop recurrent infections that can complicate their general health Although most children with ASB remain asymptomatic, certain high-risk groups—such as those with vesicoureteral reflux, congenital urinary tract anomalies, or immunodeficiencies—are more susceptible to adverse outcomes. (10)

Socioeconomic and environmental factors also play a significant role in the prevalence of ASB. Limited access to clean water, crowded living conditions, and inadequate hygiene practices can increase the likelihood of bacterial colonization in the urinary tract. (11)

Understanding the epidemiology, risk factors, and potential complications of ASB is crucial for developing evidence-based guidelines for screening, early detection, and appropriate management in children. (12)

Aim of the Study

To determine the prevalence of asymptomatic bacteriuria (ASB) among school-aged children in Karbalaa and to identify the possible factors associated with ASB.

2. Patients and Methods

2.1. Study Design: Prospective cross-sectional study.

2.2. Study Setting

The study was conducted at Karbala Health Directorate primary health care centers/ Iraq and included 194 school-aged children who attended the primary care during the study period. All participants were assessed clinically and screened according to the predefined study protocol to identify those who met the criteria for ASB.

2.3. Inclusion Criteria

1. School-aged children (6–14 years)
2. Children without urinary symptoms at the time of evaluation.
3. Children able to provide a midstream urine sample.
4. Parental agreed to participated in the study and provided verbal consent.
5. Had no previous UTI.

2.4. Exclusion Criteria

1. Children presenting with any urinary symptoms (e.g., dysuria, frequency, urgency, flank pain,

fever).

2. Children with known structural kidney or bladder abnormalities previously diagnosed.
3. Current antibiotic use or antibiotic therapy within the last 14 days.
4. Inability to obtain a clean-catch midstream urine sample.
5. Contaminated urine sample for cultures.
    1. Negative urine culture results.

2.5. Data Collection

A data collection questionary (Appendix) was used to collect data completed through direct interview with the child and caregiver, clinical examination, and review of laboratory and imaging records. The following variables were collected:

- **Demographic Characteristics:** age, gender, school grade.
- **Clinical History:** History of urinary tract infection, Number of previous UTI episodes, and Recent antibiotic use within the last 14 days.
- **Urinary and Systemic Symptoms:**

–Presence of urinary symptoms

– If present: frequency, urgency, dysuria, flank pain, bedwetting, fever

- **Voiding and Hydration Pattern:** Number of urinations per day and Water intake ≥5 cups/day
- Menstrual and Hygiene Variables (Girls Only):

Menstruation started and Number of sanitary pad changes per day

- **Ultrasound Findings:** Kidney or bladder abnormalities on ultrasound
- **Urinalysis Parameters:** Pus cells, Red blood cells (RBCs), Nitrite test (positive/negative), and Presence of bacteria
- **Urine Culture:** Culture result, Identified organism, and Antibiotic susceptibility profile
- **Other Investigations:**

– Complete blood count (CBC) and Renal function tests (RFT)

A midstream clean-catch urine sample was obtained after verbal instruction. The child initiated urination into the toilet, and midway through the stream, a sterile container was used to collect the specimen.

Blood and urine samples were sent to the health center laboratory and processed using standardized operating procedures, including automated hematology analysers for complete blood counts, automated biochemical analysers for renal function tests, and microbiology protocols for urinalysis and urine culture. Urine cultures were incubated on appropriate media, and organism identification and antibiotic susceptibility testing were done. ASB cases was defined as bacterial growth on urine culture with No urinary symptoms, no current antibiotic use and no contaminated sample.

Laboratory results were later collected by the researcher and added to each patient questionnaire. All data from the paper questionaries were entered into a Microsoft Excel and sent for statistical analysis.

2.6. Statistical Analysis

Data analysis was done using IBM® Statistical Package for Social Sciences (SPSS) version 27 for Microsoft® Windows 11. Results were presented in simple measures of frequency, percentage, mean, range, and standard deviation and illustrated as tables and figures.

The prevalence of asymptomatic bacteriuria was calculated as the proportion of children meeting the diagnostic criteria among the total screened population. Associations between ASB and selected variables (e.g., age, gender, prior UTI, voiding pattern) were assessed using chi-square or Fisher's exact test for categorical variables and independent samples t-test for continuous variables where applicable. A p-value less than 0.05 was considered statistically significant.

2.7. Ethical consideration

- Verbal consent was obtained from all patients' parents prior to enrolment.
- Data and information of the participants were kept confidential and used only for research purposes.

3. Results

A total of 194 school-aged children were included in the study. The mean age of the patients was 9.3 ± 2.4 years. Ages range from 6 to 14 years. (52.6%) were 6–9 years and 47.4% were 10–14 years. Males were 98 (50.5%) and females were 96 (49.5%). 112 children were in primary school (57.7%) and 82 (42.3%) were in intermediate school. As shown in Table 3.1.

Table 3.1.: Demographic characteristics of the study children (n = 194)

Variable	n	%
Age (years)		
6–9 years	102	52.6
10–14 years	92	47.4
Mean ± SD	9.3 ± 2.4	

Range	6–14	
Gender		
Male	98	50.5
Female	96	49.5
School grade		
Primary	112	57.7
Intermediate	82	42.3

Out of the 194 children that were screened 13 had positive culture and bacterial growth without urinary symptoms, The prevalence of asymptomatic bacteriuria was 6.7%. The remaining 181 children (93.3%) had negative urine cultures and were classified as no ASB. As shown in figure 3.1.

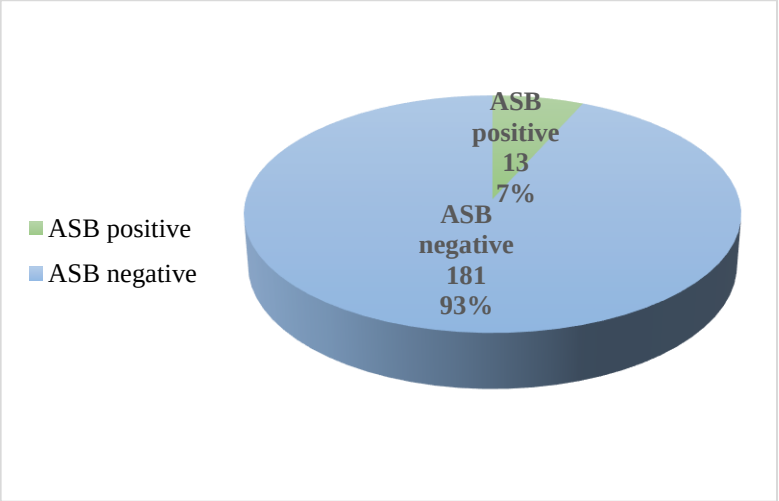

Figure 3.1.: Prevalence of asymptomatic bacteriuria among the study sample (n=194)

Escherichia coli was the most common organism (62%) followed by Klebsiella species (15%), Proteus species (15%) and Enterococcus species (8%). As shown in figure 3.2.

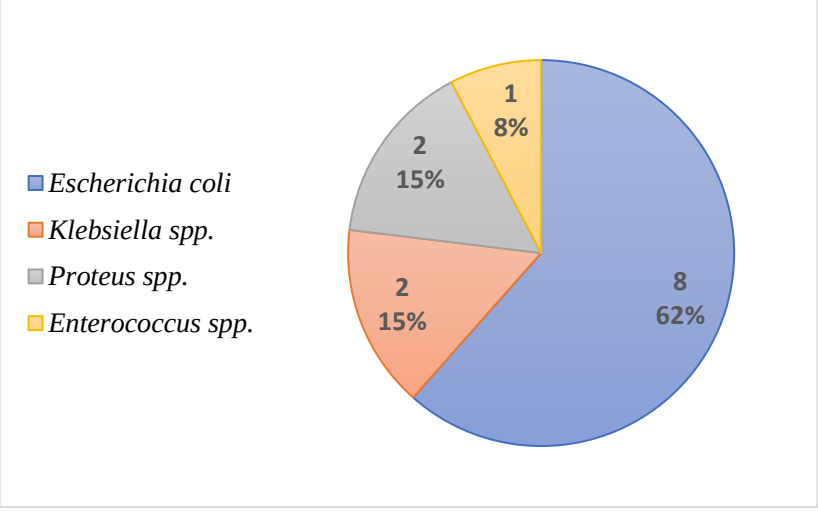

Figure 3.2.: Isolated organisms among ASB patients (n = 13)

In urinalysis pus cells were present in 30.8% of ASB children compared with 9.4% of non-ASB children and this difference was statistically significant (p = 0.041). Red blood cells were present in (23.1%) of ASB children and in (6.1%) of non-ASB children with no statistical significance difference (p = 0.063). Nitrite test was positive in (38.5%) of ASB children compared with (5%) of non-ASB children and this difference was highly significant (p < 0.001). Bacteriuria detected by microscopy was positive (53.8%) of ASB children compared with (7.7%) of non-ASB children and this difference was highly significant (p < 0.001). As shown in Table 3.2.

Table 3.2.: Urinalysis findings among children with and without ASB.

Urinalysis finding	ASB positive n (%)	ASB negative n (%)	p-value
Pus cells			
Present	4 (30.8)	17 (9.4)	0.041
Absent	9 (69.2)	164 (90.6)	
RBCs			
Present	3 (23.1)	11 (6.1)	0.063
Absent	10 (76.9)	170 (93.9)	
Nitrite test			
Positive	5 (38.5)	9 (5.0)	<0.001
Negative	8 (61.5)	172 (95.0)	
Bacteria			
Present	7 (53.8)	14 (7.7)	<0.001
Absent	6 (46.2)	167 (92.3)	

There was no statistically significant difference in laboratory findings between ASB patients and children without ASB with all P-values above the significant level of 0.05 for hemoglobin, white blood cell count, serum creatinine and blood urea. As shown in Table 3.3.

Table 3.3.: Laboratory findings among children with and without ASB.

Parameter	ASB positive (Mean ± SD)	ASB negative (Mean ± SD)	p-value
Hemoglobin (g/dL)	12.3 ± 1.1	12.6 ± 1.0	0.141
WBC (×10³/µL)	8.7 ± 2.0	8.4 ± 1.9	0.362
Serum creatinine (µmol/L)	41 ± 7	40 ± 6	0.158
Blood urea (mmol/L)	4.2 ± 0.9	4.0 ± 0.8	0.155

Regarding sensitivity nitrofurantoin had the highest sensitivity with 11 cultures sensitive (84.6%) and 2 resistance (15.4%). Gentamicin was sensitive in 9 (69.2%) and resistance in 4 (30.8%). Ceftriaxone was sensitive in 8 (61.5%) and resistant in 5 (38.5%) were. Ciprofloxacin was sensitive in 7 (53.8%) and resistant in 6 (46.2%). Amoxicillin–clavulanate had the lower sensitivity only 6 (46.2%) and resistance in 7 (53.8%). As shown in figure 3.3.

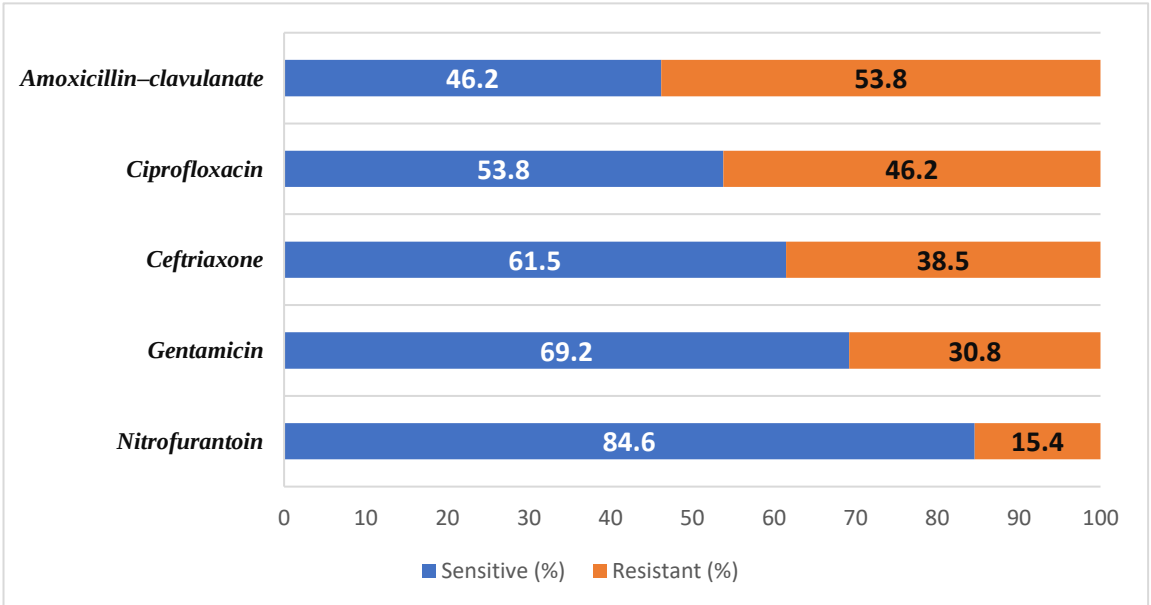

Figure 3.3.: Antibiotic susceptibility pattern of isolated organisms (n = 13)

Seven children aged 6–9 years (6.9%) had ASB compared to 6 children aged 10–14 years (6.5%). The difference between age groups was not statistically significant (p = 0.818). Gender showed a significant association with ASB. Only three males (3.1%) had ASB compared with 10 females (10.4%). The difference was statistically significant (p = 0.031).

Among children who urinated four times or less per day 7 (9.1%) had ASB positive, while 6 children (5.2%) who urinated more than 4 times per day had ASB. This difference was not statistically significant (p = 0.158). Water intake showed a significant association with ASB. Ten children who drink less than 5 cups/day had ASB (9.5%) compared TO 3 children drink 5 or more cups/day (3.4%). The difference was statistically significant (p = 0.027).

Among girls who had started menstruation (total 46) 4 girls (8.7%) had ASB compared to 6 girls who had not started menstruation (12.0%). This difference was not statistically significant (p = 0.161). Among girls who started menstruation pad changes per day were significantly associated with ASB. Among girls who changed pads less than 3 times/day 3 (14.3%) had ASB, compared to one girl (4%) who changed pads 3 or more times per day. This difference was statistically significant (p = 0.018). As shown in table 3.4.

Table 3.4.: Variables association with asymptomatic bacteriuria

Variable	Category	ASB positive n (%)	ASB negative n (%)	p-value
Age	6–9 years	7 (6.9)	95 (93.1)	0.818
	10–14 years	6 (6.5)	86 (93.5)	
Gender	Male	3 (3.1)	95 (96.9)	0.031
	Female	10 (10.4)	86 (89.6)	
Urination/day	≤4 times	7 (9.1)	70 (90.9)	0.158
	>4 times	6 (5.2)	111 (94.8)	
Water intake ≥5 cups/day	Yes	3 (3.4)	86 (96.6)	0.027
	No	10 (9.5)	95 (90.5)	
Menstruation started (girls)	Yes	4 (8.7)	42 (91.3)	0.161
	No	6 (12.0)	44 (88.0)	
Pad changes	<3 /day	3 (14.3)	18 (85.7)	0.018
	≥3 /day	1 (4.0)	24 (96.0)	

4. Discussion

this study the overall prevalence of asymptomatic bacteriuria (ASB) among school aged children was 6.7%, this is consistent with findings from a large cross sectional study in Egypt by Mohammed et al. included 1,000 healthy school children aged 6–12 years, including 552 boys (55.2%) and 448 girls (44.8%) found that the overall prevalence of significant bacteriuria was 6%. And that ASB was more common in girls (11.4%) than in boys (1.6%). In their study Escherichia coli was the most frequently isolated organism, accounting for 58% of cases, followed by Staphylococcus aureus (22%), Enterobacter species (10%), Klebsiella pneumoniae (5%), and Proteus vulgaris (5%). (13)

Globally a meta-analysis study by Shaikh et al. that included 14 articles involving 49,806 children from England, France, Germany, Italy and Spain found that the prevalence of asymptomatic bacteriuria was 0.37% in boys and 0.47% in girls. (14)

Some studies like Moses et al. study in Ebonyi State that included 600 school children found the overall prevalence of asymptomatic UTI of 48% of the children and Staphylococcus aureus was the most commonly isolated organism (43.6%), followed by Escherichia coli (16.0%). (15)

In the current study Escherichia coli was the most common causative isolated organism in ASB cases aligns with Tanaka et al. study which demonstrate that E. coli is the most common uropathogen in both

symptomatic and asymptomatic urinary tract colonization and that E. coli possesses virulence factors facilitating adherence and colonization of the urinary tract mucosa. (16)

The current study results show that female gender was significantly associated with ASB. This is consistent with Hussein et al. study in Al-Zahraa Teaching Hospital for Maternity and Children, Najaf, Iraq that included 400 primary school–aged girls and concluded that asymptomatic bacteriuria had a prevalence of 7% among school-aged girls, particularly in the 6–9-year age group, with E. coli being the predominant causative organism. (17)

The higher rates in females compared to males likely due to anatomical differences, such as a shorter urethra and closer proximity of the urethral opening to the perianal area.

The current study show significant association between low water intake and ASB. hydration status influences urinary tract microbial colonization and adequate fluid intake increases urine flow, which may help mechanically flush bacteria from the lower urinary tract. Among girls who had started menstruation lower frequency of sanitary pad changes (<3 times per day) was significantly associated with ASB. This reflect poor perineal hygiene. This is consistent with Lamiya et al. study on 110 school-going girls aged 10–13 years that found statistically significant association with insufficient water consumption during school hours, poor menstrual hygiene, use of school toilets, and a prior history of UTI. (18)

Pus cells, nitrite positive test and presence of bacteria on microscopy were significantly more common in ASB positive children. Nitrite positivity indicates bacterial reduction of urinary nitrates and is a marker for significant bacteriuria. (19)

Although guidelines including Infectious Diseases Society of America (IDSA) and pediatric nephrology and urology societies recommendations show that ASB in children usually does not require treatment, except before certain urological procedures. Nitrite dipstick tests are specific but have limited sensitivity—frequent voiding, low dietary nitrates, and infections with non–nitrite-producing bacteria can cause false negatives. (6)

Nitrite positivity alone cannot distinguish ASB from symptomatic UTI, and relying solely on nitrite results for diagnosis or treatment is not recommended. Diagnosis of UTI should combine clinical symptoms, urine culture, and supportive urinalysis. Nitrite tests are useful as a screening tool but should not guide treatment decisions independently. (20)

The current study found no significant differences in other laboratory tests (hemoglobin, white cell count, creatinine, urea) between ASB positive and ASB negative children. This result suggests that ASB in healthy pediatric populations may not be associated with systemic inflammation or renal dysfunction, ASB often remains a localized urinary condition without systemic sequelae and requires no treatment unless it progressed to symptomatic UTI. (21)

In the current study sensitivity results show that nitrofurantoin showed the highest sensitivity, it could be an effective empiric agent in lower urinary tract infections. Susceptibility patterns are different by region and nitrofurantoin could be the least given antibiotic in by hand prescriptions in local pharmacies when compared to other antibiotics.

A study by Salman et al. that collected 302 urine samples from children aged 6 months to 12 years aimed to isolate and identify the bacteria responsible for pediatric UTIs in Baghdad, Iraq, and to assess their antibiotic susceptibility found that Escherichia coli was the most prevalent bacterium and had the highest antibiotic resistance. They concluded that carbapenems and aminoglycosides are the most effective options for empirical treatment of pediatric UTIs, whereas quinolones, penicillins, and cephalosporins are less effective and recommended regular antibiotic susceptibility testing to monitor resistance patterns and guide appropriate therapy. (22)

5. Conclusions

1. The prevalence of asymptomatic bacteriuria among school-aged children was 6.7%.
2. Escherichia coli was the most common causative organism followed by Klebsiella, Proteus, and Enterococcus species.
3. Pus cells, positive nitrite and bacteria seen on microscopy were significantly higher among children with ASB.
4. Nitrofurantoin was the most effective antibiotic, while amoxicillin–clavulanate had the lowest sensitivity.
5. Female gender, low water intake and infrequent pad changes during menstruation were significantly associated with higher ASB prevalence.

6. Recommendations

1. Consider routine screening for ASB for school-aged girls, especially those with low water intake or poor menstrual hygiene practices.
2. Promoting adequate hydration in children to reduce the risk of ASB.
3. Encouraged menstrual hygiene including frequent

pad changes that should be changed frequently for better hygiene among menstruating girls.

4. Awareness programs for health providers in primary health centers and parents about risk factors and prevention of ASB.
5. Conduct further studies with larger sample size and longer follow up to assess long-term outcomes of untreated ASB and progression rate to symptomatic UTI.

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