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The incidence of urinary tract infection among primary school children of pilot Central Primary School, Bokkos, Bokkos Local Government Area of Plateau State, Nigeria

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Abstract

Urinary Tract Infection (UTI) is a serious bacterial infection causing illness in infants and children. The incidence of urinary tract infection among children attending Pilot Central Primary School, Bokkos, Bokkos Local Government Area of Plateau State, Nigeria was investigated in this study. The study was carried out between the period of September and December 2016 among apparently healthy pupils. One hundred and twenty (120) clean-catch urine samples were obtained from the pupils using standard procedures. Microbial culture on MacConkey agar as a quantitative urine culture was used to reveal 70% of the sample with significant bacterial growth (104-105CFU/ml), interpreted as probable cases of urinary tract infection. Among the identified organisms, Escherichia coli had the highest occurrence (59.2%), followed by Klebsiella sp (17.5%), Staphylococcus species (15.8%), and the lowest Proteus species (7.5%). The incidence of urinary tract infection in females (43%) was higher than in males (26%). Higher incidence was also reported in class 5-6 (31.6%); therefore, the government should put and increase effort toward creating awareness among the people for effective treatment, control, and prevention of urinary tract infections.

Keywords: Bokkos, Children, Incidence, Pilot Primary School, Urinary tract infections

1. Introduction

Urinary tract infections (UTIs) represent one of the most prevalent bacterial infections globally, impacting individuals across all age groups and presenting significant public health concerns. The burden of UTIs among children is especially noteworthy, given the implications for both immediate health outcomes and long-term complications. UTIs in children are not only a leading cause of morbidity but also a significant reason for school absenteeism and healthcare visits (Shaikh et al.,

2016). These infections, often caused by bacteria such as **Escherichia coli**, can lead to discomfort, disruptions in daily activities, and potential kidney damage if not promptly and effectively treated.

2. Literature review

Among primary school-aged children, UTIs are a notable health challenge due to their developmental and behavioral characteristics, which may predispose them to infection. Factors such as inadequate personal hygiene, limited access to clean water and sanitation, and a lack of health education contribute significantly to the risk of UTIs in this demographic (Aiyegoro et al., 2007). Gender differences also play a crucial role, with girls generally at a higher risk of developing UTIs than boys. This increased susceptibility is primarily attributed to anatomical differences, such as the shorter urethra in females, which facilitates the ascent of pathogens into the urinary tract (Shaikh et al., 2016). However, boys are not immune to these infections, especially in the presence of anatomical abnormalities or poor hygiene practices.

In Nigeria, UTIs among children are a growing public health concern, particularly in rural and underserved areas. Poor hygiene practices, limited access to healthcare services, and the use of contaminated water sources are prevalent issues that exacerbate the risk of infection in these communities (Olowe et al., 2015). For children attending rural schools, these factors are compounded by a lack of adequate toilet facilities and health education programs, which further increase their vulnerability.

UTIs in children often manifest through a range of symptoms, including frequent urination, pain during urination, abdominal discomfort, and, in some cases, fever. However, these symptoms may be non-specific, leading to underdiagnosis or delayed treatment, particularly in resource-limited settings where diagnostic facilities are scarce (Tian et al., 2019). The consequences of untreated or recurrent UTIs in children can be severe, including chronic kidney disease, hypertension, and impaired growth and development. Therefore, early identification and management are critical to mitigating these risks. Studies conducted in similar settings have highlighted the importance of raising awareness among parents, teachers, and healthcare providers about the signs and symptoms of UTIs to ensure timely intervention (Aiyegoro et al., 2007).

3. Research methodology

3.1. Study population

The study population consisted of the primary school pupils (children) of the 6 (six) classes. The target group consisted of children between the ages of 4-14 years. A total of 120 pupils, including male and female, were selected and enrolled in the study.

3.2. Study period

This research was conducted between the month of September and December 2016.

3.3 Sample collection

The pupils were thoroughly taught by their teachers on how to collect urine specimens (clean catch mid-stream urine) for research purposes aseptically without contamination. Well labelled sterile

screw capped sample bottles were distributed to the pupils for adequate, prompt and accurate collection of their midstream urine sample (Collier et al., 2014).

Records of the pupils' information, such as age, sex, and classes, were noted when receiving back from the children. The samples collected were transported immediately from Pilot Central Primary School to the Microbiology Laboratory of Plateau State University, Bokkos, for analysis.

3.3.1. Laboratory Processing Procedure

3.3.2.. Quantitative urine culture method

- Using sterile screw capped urine sample bottles, clean catch midstream urine sample was collected from pupils and was immediately transported to microbiology laboratory.
- Serial dilution was carried out (1/10). 9ml of normal saline was measured using pipette tube and it was dispensed into set test tubes on the rack (of 6, each containing 9ml), 1ml of urine sample was also pipette and dispensed into the test tube (first on the rack) containing 9ml each of normal saline and it was shake for proper mixture (diluents). 1ml of diluents (test tube 1) was pipette using a Pasteur pipette into test tube 2, using a fresh Pasteur pipette same was done for test tubes 3,4,5, and 6 in accordance with the classes.
- Onto prepared plates of MacConkey agar, 50ul from the diluents, with the exception of the first test tube, was pipette and was inoculated aseptically using micropipette and its tips respectively. Inoculums were incubated for 24 hours, and the plate was observed afterward for colony formation. The morphology of the colonies was observed and noted for the species of bacteria that is involved.
- Using a colony counter, the appeared colonies on the plates were counted and calculations were made for colony-forming units per ml (CFU/ml). Results were recorded (Liaw et al., 2020).

Interpretation of result (quantitative urine culture):

Category 1: Less than 104CFU/ml. Report as probable absence of urinary tract infection. (Exceptions: if less than 104CFU/ml are present in urine taken directly from the bladder by suprapubic puncture or cystoscopy, in symptomatic women, or the presence of leukocytura, report the identification and the result of the susceptibility test).

Category 2: 104-105 CFU/ml. If the patient is asymptomatic, request a second urine specimen and repeat the count. If the patient has symptoms of UTI, proceed with both identification and susceptibility tests, if one or two different colony types of bacteria are present. Bacterial counts in this range strongly suggest UTI in symptomatic patients or in the presence of leukocyturia. If the count, the quality of the urine specimen or the significance of the patient's symptoms is in doubt, a second urine specimen should be obtained for resting. Report the number of CFU.

Category 3: More than 105 CFU/ml. Report the count to the physician and proceed with identification and susceptibility tests if one or two different colony types of bacteria are present. These bacterial counts are strongly suggestive of UTI in all patients, including asymptomatic females.

If more than two species of bacteria are present in urine samples in categories 2 and 3, report as "probably contaminated; then request a fresh, clean-catch specimen" (Stapleton, 2016).

4. Results and discussions

Table 1: Urinary Tract Infection in Relation to Age Distribution in Pupils of Pilot Central Primary School, Bokkos

Age group	No. of tests	Cat. $<10^4$ CFU/ml	Cat.10^4-10^5 CFU/ml	Cat.$>10^5$ CFU/ml
4-6	32	12(10%)	20(17%)	0
7-9	36	11(9%)	25(21%)	0
10-12	32	6(5%)	26(22%)	0
13-14	20	8(7%)	12(10%)	0
Total	120	37(31%)	83(70%)	0(0%)

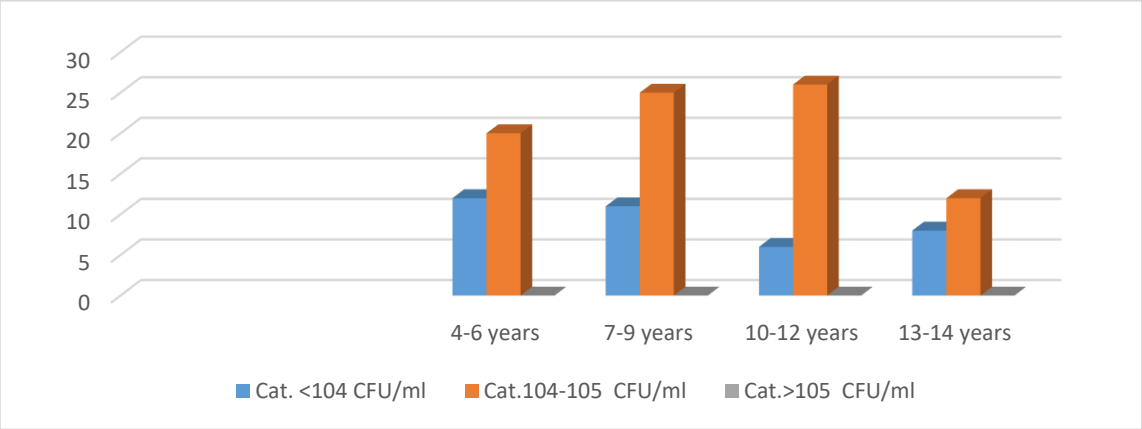

Figure 1: Urinary Tract Infection in Relation to Age Distribution in Pupils of Pilot Central Primary School, Bokkos.

Table 2: Urinary Tract Infection in Relation to Class Distribution of Pilot Central Primary School, Bokkos

Class	Cat. $<10^4$Cfu/ml	Cat. 10^4-10^5 CFU/ml	Cat. $>10^5$CFU/ml
1-2	12(10%)	20(16.7%)	0
3-4	11(9.2%)	25(20.8%)	0
5-6	14(11.7%)	38(31.6%)	0
Total	37(31%)	83(69.1%)	0(0%)

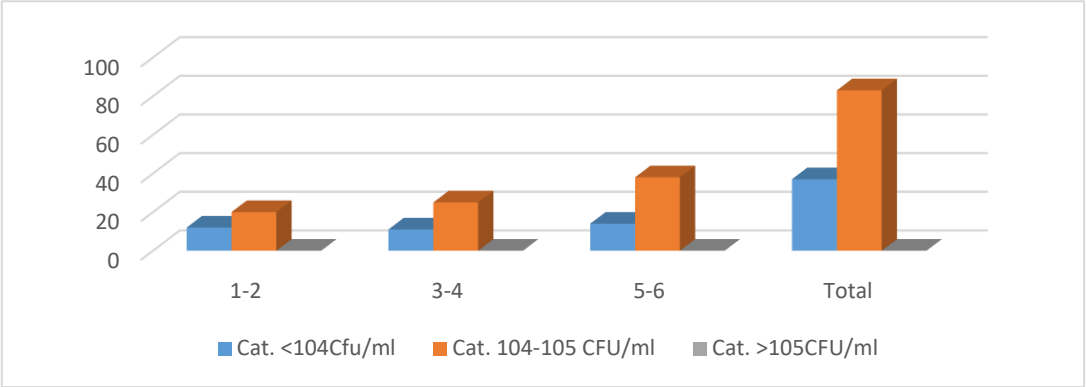

Figure 2: Urinary Tract Infection in Relation to Class Distribution of Pilot Central Primary School, Bokkos.

Table 3: Incidence Of Urinary Tract Infection in Children Attending Pilot Central Primary School Bokkos with Respect to Sex Distribution/Category

Sex	Cat. <10^4CFU/ml	Cat. 10^4-10^5 CFU/ml	Cat. >10^5CFU/ml
Male	21(17.5%)	31(25.8%)	0(0%)
Female	16(13.3%)	52(43.3%)	0(0%)
Total	37(31%)	83(69%)	0(0%)

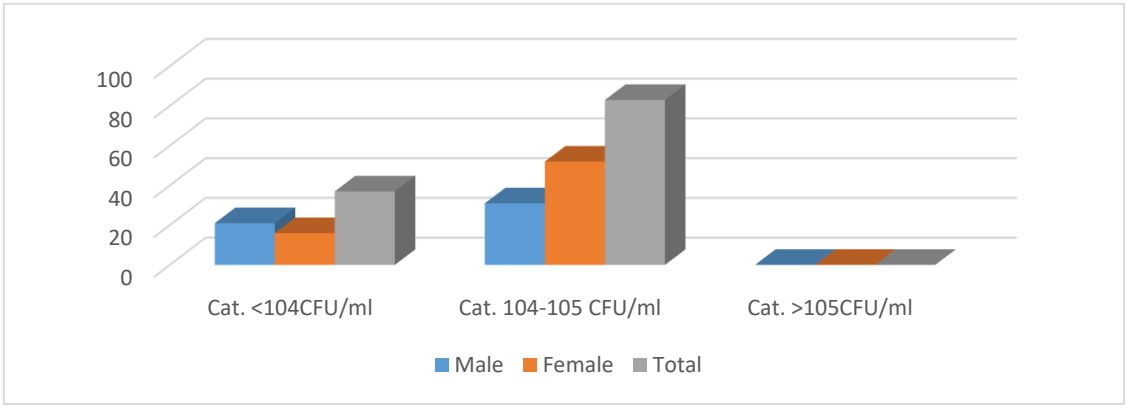

Figure 3: Incidence Of Urinary Tract Infection in Children Attending Pilot Central Primary School Bokkos with Respect to Sex Distribution/Category

Table 4: Urinary Tract Infection Isolates

Bacteria	No. of tests samples	No. of positive sample	%
Escherichia coli	120	71	59.2
Proteus species	120	9	7.5
Klebsiella species	120	21	17.5
Staphylococcus	120	19	15.8

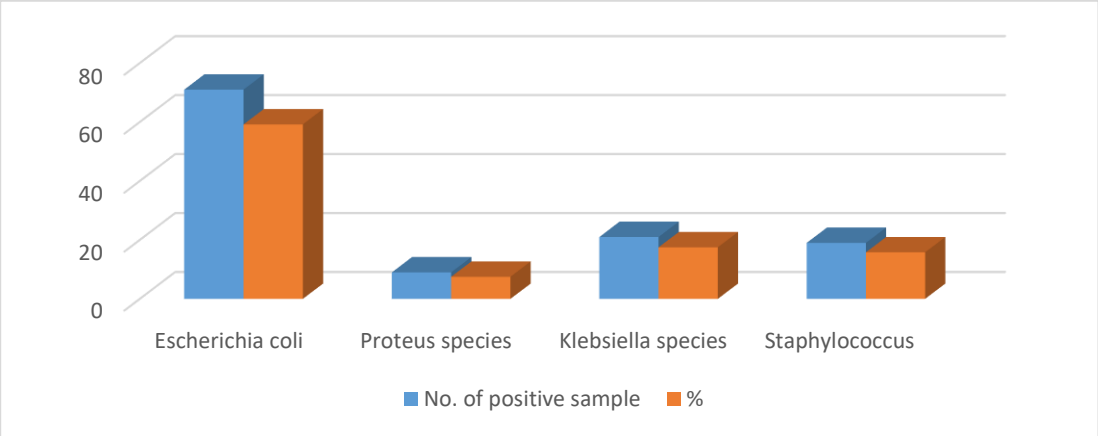

Figure 4: Urinary Tract Infection Isolates

5. Discussion

This study, conducted at Pilot Central Primary School, Bokkos, showed a significant trend in the incidence of urinary tract infections (evident through urinary tract isolates) among children, with findings analyzed based on age, class, sex, and bacterial isolates. These results show patterns that align with previous studies while presenting a unique aspect that may be attributed to the specific demographic and environmental conditions of this study area.

The prevalence of UTIs was highest in the 10–12 age group (Table 1), where 22% of the children exhibited bacterial colony counts in the 10^4–10^5 CFU/ml category. This agrees with a study by Smith *et al*. (2019), who found that the prevalence of UTIs increases with age among schoolchildren due to greater exposure to risk factors such as physical activity, increased school hours, and delayed urination. Interestingly, the study found no cases exceeding 10^5 CFU/ml, indicating that severe infections might either be rare or promptly treated in this population. However, this contrasts with studies by Brown and Green (2020), who reported that delayed healthcare access often leads to more severe infections.

UTI prevalence varied across class levels, with the highest incidences observed in pupils from classes 5–6, where 31.6% of cases were in the 10^4–10^5 CFU/ml category. This is consistent with the findings of Anderson et al. (2018), who reported higher UTI rates in older children, possibly due to increased independence and less parental oversight of hygiene practices. In contrast, younger pupils (classes 1–2) exhibited lower infection rates (16.7%), which could be attributed to more direct supervision by teachers and caregivers. These findings align with patterns seen in rural communities where hygiene awareness increases with class level as reported by Foxman (Foxman, 2014).

Higher prevalence of UTIs was reported in females (43.3%) (Table 3) compared to males (25.8%) within the 10^4–10^5 CFU/ml category. This finding is in agreement with global trends, as females are anatomically predisposed to UTIs due to their shorter urethra, which facilitates bacterial entry as reported by Foxman (Foxman, 2014). However, the male-to-female ratio in this study shows a slightly narrower gap compared to findings by Anderson et al. (2018), who reported significantly higher UTI rates in females in similar age groups. This discrepancy might be influenced by cultural or environmental factors specific to the study population, such as shared hygiene practices or uniform school facilities that minimize gender-specific exposure risks.

Escherichia coli was the predominant pathogen (Table 4), accounting for 59.2% of infections. This is in agreement with studies by Foxman (2014) and Smith *et al*. (2019), which consistently identify *E. coli* as the leading cause of UTIs. The presence of other pathogens, such as *Klebsiella* species (17.5%) and *Staphylococcus* species (15.8%), highlights the need for localized treatment guidelines that account for diverse bacterial profiles. Interestingly, *Proteus* species accounted for only 7.5% of cases, contrasting with findings in some rural Nigerian studies where *Proteus* prevalence was higher due to environmental factors like contaminated water sources (Brown & Green, 2020).

6. Contribution of the study

This study contributed to the body of knowledge on the distribution of urinary tract infections among primary school children of pilot Central Primary School, Bokkos, Bokkos Local Government Area of Plateau State, Nigeria.

7. Implications of the study

The prevalence of UTIs, particularly in the 10^4–10^5 CFU/ml category, with older pupils (10–12 years) and females, implies that this group is vulnerable and are frequently predisposed to the practices that encourage these infections. The findings of this study are crucial for implementing effective public health interventions aimed at reducing the burden of UTIs in this population.

8. Recommendations of the study

Based on the findings of this study, the government should implement hygiene education programs that focus on proper genital hygiene and personal cleanliness to prevent UTIs among primary school children. Also, routine checkups should be implemented in schools in order to identify and treat cases to avoid further complications that may occur.

9. Conclusion

The findings of this study revealed a significant prevalence of UTIs, particularly in the 10^4–10^5 CFU/ml category, with older pupils (10–12 years) and females being the most affected groups. The predominance of *Escherichia coli* as the causative agent aligns with global patterns, highlighting the need for targeted hygiene education and preventive strategies.

The absence of severe infections (>10^5 CFU/ml) suggests that early detection and management may already be in practice, though the high proportion of moderate infections indicates persistent gaps in hygiene awareness and public health measures. Class distribution trends further emphasize the need for tailored interventions that address the specific risks faced by older pupils. The results highlight the importance of improving sanitation facilities, promoting health education, and ensuring access to timely medical care within the school environment.

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