

# Prevalence and incidence of asymptomatic bacteriuria among Nigerian children and adolescents with type 1 diabetes mellitus.

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**ABSTRACT** *Background:* It is commonly believed that patients with diabetes mellitus are at increased risk of urinary tract infection than non-diabetic patients.

*Objective:* To determine the prevalence and incidence of asymptomatic bacteriuria (ASB) among children and adolescents with type 1 diabetes mellitus and compare the result with that of their non-diabetic peers.

*Methods:* Bacteriuria was screened for in 34 patients (17 with type 1 diabetes mellitus and 17 with non-diabetic endocrine disorders) at their regular follow-up visits to our Paediatric Endocrine Clinic, using clean midstream freshly voided urine specimens collected every three months for 12 months from each of the 34 children and adolescents and cultured. The subjects were matched for age and sex. The results of the culture of each urine specimen (four for each patient) were recorded and analyzed at the end of the study period.

*Results:* Among the 34 patients screened, only two (one, 5.9%, out of 17 diabetic and one, 5.9%, out of 17 non-diabetic) had asymptomatic bacteriuria and the urine culture of each of them yielded a growth of *Escherichia coli* sensitive to gentamycin. The duration of diabetes in the girl with ASB was 7 years. She had a poor glycaemic control and some psychosocial challenges. Her pubertal maturation was delayed (Tanner Stage II at the age of 15 years and has not attained menarche). She weighed 29 Kg, with BMI of 16.0 kg/m<sup>2</sup>. In addition, she had vaginal candidiasis for which she was appropriately treated, using ketoconazole. The other patient with ASB was a 7-year-old girl with precocious puberty due to congenital adrenal hyperplasia diagnosed at the age of 18 months. The two patients with ASB did not progress to symptomatic bacteriuria after a follow-up period of one year.

*Conclusion:* The prevalence and incidence of asymptomatic bacteriuria in diabetic children and adolescents do not differ from those of their non-diabetic counterparts.

*Key Words:* Asymptomatic bacteriuria, Adolescence, Childhood, Diabetes mellitus, Incidence.

## INTRODUCTION

Asymptomatic bacteriuria refers to the presence of a positive urine culture in an asymptomatic person.<sup>1</sup> It is commonly believed that individuals with diabetes mellitus are at increased risk of infection, particularly urinary tract infection (UTI)<sup>2-4</sup>. Such an infection in diabetic patients may result in severe complications and death more frequently than would be anticipated among non-diabetics<sup>2,4</sup>. Most UTI in diabetic patients are relatively asymptomatic.<sup>4</sup> Among diabetic patients, factors presumed to predispose to UTI include age, neurogenic bladder, duration of diabetes and degree of glycaemic control<sup>2,5</sup>. Some clinicians consider

asymptomatic patients being screened for bacteriuria to be at risk of UTI if two or three consecutive cultures of freshly voided urine reveal more than 10<sup>5</sup> organisms/ml<sup>6</sup>. Whether or not individuals with asymptomatic bacteriuria (ASB) should be treated with antibiotics remains debatable<sup>4</sup>. It is recommended that ASB should be treated with antibiotics in pregnant women, children aged 5-6 years and prior to invasive genitourinary procedures<sup>7</sup>.

It is not known with certainty whether individuals with diabetes mellitus are at a higher risk of bacteriuria than non-diabetics. Studies on this subject have yielded mixed results. For instance, Lindberg et al<sup>8</sup>

**Table 1.** Age and gender distribution of patients with diabetes mellitus.

Age group at presentation	Gender		
	Male No (%)	Female No (%)	Both sexes No (%)
Below 10 years	2 (33.3)	0 (0)	2 (11.8)
10-12 years	0 (0)	3 (27.3)	3 (17.6)
13-15 years	3 (50.0)	8 (72.7)	11 (64.7)
Above 15 years	1 (16.7)	0 (0)	1 (5.9)
<b>Total</b>	6 (100.0)	11(100.0)	17 (100.0)

reported that 3 out of 304(0.99%) girls and zero out of 337 boys with type 1 diabetes mellitus screened for bacteriuria were positive. They, therefore, concluded that the prevalence of ASB in diabetic children and adolescents did not differ from that of their non-diabetic peers. In contrast, a meta-analysis of published data involving 22 studies revealed that the prevalence of ASB was 12.2% in diabetic children compared with 4.5% in healthy controls<sup>9</sup>. Point prevalence was also higher in children and adolescents with diabetes (12.9%) compared with their non-diabetic (2.7%) counterparts<sup>9</sup>. A similar increased risk among diabetic children and adolescents was reported from Egypt<sup>10</sup>. Some studies have concluded that screening for ASB in diabetic patients is warranted because it has been found to be a risk factor for developing symptomatic urinary tract infection<sup>11</sup>. In a survey in Port Harcourt, Nigeria of secondary school students aged 10-17 years the prevalence of ASB was 6.5% and 4.5% in girls and boys respectively<sup>12</sup>.

Despite the recognized potential of ASB in diabetic patients to cause renal damage and ultimately, chronic kidney disease, there is a general paucity of information in the literature on its prevalence, particularly in developing countries. Besides, it is not known how often ASB progresses to symptomatic bacteriuria. In addition, infection itself can lead to poor diabetic control by increased secretion of counterregulatory hormones (glucagon, cortisol, growth hormone, catecholamines), inhibition of insulin secretion, and insulin resistance of peripheral tissues/increased cytokine secretion<sup>13,14</sup>.

The purpose of the present study is to determine the prevalence and incidence of ASB among children

and adolescents with T1DM attending the Paediatric Endocrine-Metabolic Clinic, UBTH and compare the result with those of their non-diabetic peers.

### SUBJECTS AND METHODS

The study was conducted in the Paediatric Endocrine-Metabolic Clinic of the University of Benin Teaching Hospital (UBTH), Benin City, Nigeria over a 12-month period for each of the subjects. The study was approved by UBTH Ethical Committee. Consent was obtained from both the patient and their parents. Information sought from the subjects included age, sex, parents educational attainment, parents occupation, antibiotic use and duration of type 1 diabetes mellitus (T1DM). Patients with complaints suggestive of symptomatic urinary tract infection (such as dysuria, frequent micturition, urgency, pain in the loin or suprapubic region) were excluded from the study. The socio-economic status of the parents of the subjects was determined using the classification suggested by Ogunlesi et al<sup>15</sup>. This was analyzed via combining the highest educational attainment, occupation and income of the parents (based on the mean income of each educational qualification and occupation). In this Social Classification System, classes I and II represent high social class, class III represents middle social class while classes IV and V represent low social class. In this way, the subjects were categorized into high, middle and low socio-economic groups.

A clean catch mid-stream urine specimen was obtained from each of the subjects every three months, over a total period of 12 months, amounting to four urine specimens per subject. In all the subjects, appropriate care was taken before collection of the urine

specimen to avoid contamination. Each urine specimen was transported to the Research Laboratory, Department of Child Health, UBTH, where it was refrigerated immediately and cultured within two hours of collection. All the urine samples were cultured on Blood and MacConkey agar plates. The plates were incubated at 37°C aerobically for 48 hours. Standard procedure was applied in the handling, staining, microscopy and culture of all the urine specimens<sup>16</sup>. Full clinical examination was conducted on each of the subjects at every visit. The presence of bacterial growth of  $10^5$  colony-forming units/ml was accepted as significant bacteriuria<sup>17</sup>. Descriptive statistics such as frequencies, means, ratios, standard deviations, confidence intervals, percentages were used to describe all the variables.

## RESULTS

Out of 17 patients with type 1 diabetes mellitus screened, only one (5.9%) had significant asymptomatic bacteriuria (ASB) and the urine culture yielded a growth of *Escherichia coli* sensitive to gentamycin. Among the 17 non-diabetic patients only one (5.9%) had ASB. The patient was a 15-year-old girl diagnosed of type 1 diabetes mellitus 7 years ago. She had a poor glycaemic control and some psychosocial challenges. Her pubertal maturation was delayed (Tanner Stage II at the age of 15 years and has not attained menarche). She weighed 29 Kg, with BMI of 16.0 kg/m<sup>2</sup>. In addition, she had vaginal candidiasis for which she was appropriately treated, using ketoconazole. During the follow-up, appropriate urine samples were collected and screened every 3 months for 12 months for each of the subjects but no other patient had significant asymptomatic bacteriuria. The only patient with significant asymptomatic bacteriuria did not progress to symptomatic bacteriuria after two years of follow up. The mean age at presentation of the subjects was  $11.0 \pm 4.2$  years (95% Confidence Interval, CI = 7.7-14.7) for boys;  $13.5 \pm 1.6$  years (95% CI = 12.6 - 14.4) for girls;  $12.8 \pm 2.9$  years (95% CI = 11.4 - 14.1) for both sexes combined. Mean age at presentation: boys versus girls  $t = 1.28$   $p > 0.05$ . The age and gender distribution of the subjects is depicted in Table 1. The mean body mass index (BMI) was  $18.6 \pm 2.5$  kg/m<sup>2</sup> (95% CI = 17.4 - 19.8) with 6 (35.3%) having a BMI below 19.0 kg/m<sup>2</sup>. None of the subjects had

BMI > 25 kg/m<sup>2</sup>. Over half of the families (52.9%) of the subjects were in the middle social class. Eleven point eight percent and 35.3% of the families of the subjects were in the high and low social classes respectively.

## DISCUSSION

The prevalence (5.9%) of asymptomatic bacteriuria (ASB) found in the present study is two- and 5-fold lower than the 12.2% and 30.0% respectively reported from two different studies, one a meta-analysis of 22 studies and the other among diabetic Egyptian children and adolescents<sup>9,10</sup>. Even, prevalence rates lower than that observed in the present study have been reported<sup>8</sup>. All reflecting the reported mixed results of prevalence of ASB in children and adolescents, suggesting that some unidentified socio-demographic factors might influence the prevalence of ASB in these subjects. For instance, age, sex, glycaemic control, duration of diabetes and presence of long-term complications have all been variously reported as risk factors<sup>2-4</sup>. The method of collection and processing of the urine specimens might have also influenced the different prevalence rates observed. The lower prevalence rate observed in the present study compared to the Egyptian study may partly be because of the differences in the age of the two study populations. Most of the subjects in the Egyptian study were older than 15 years while most the patient in the present study were below 15 years of age. This view is supported by the reports of two studies in Egypt and Hungary which separately showed the prevalence of ASB was higher in girls aged 15 years or older<sup>10,17</sup>. In consonance, the only diabetic patient with ASB in the present study was 15 years old. However, the prevalence from our data was within the range (4.5-6.5%) reported from Port Harcourt, Nigeria among non-diabetic secondary school students aged 6 to 15 years<sup>11</sup>, suggesting that ASB is not commoner in diabetic compared to non-diabetic children and adolescents. This conclusion is reinforced by the results of the present study which showed that of the two patients with ASB one was diabetic and the other was non-diabetic. Furthermore, as reported by Rozsai et al<sup>14</sup>, the urinary cytokine response to pathogens in both diabetic and non-diabetic children with bacteriuria was comparable.

Consistent with previous reports, the most com-

mon bacterial agent in the present study was *Escherichia coli*<sup>4,10,18</sup>. This finding is partly explained by the report of Geerlings et al<sup>19</sup> which indicated that *E. coli* expressing type 1 fimbriae adhere better to the uroepithelial cells of women with diabetes mellitus compared to the cells of women without diabetes mellitus. The girl with type 1 diabetes and ASB also had vaginal candidiasis which responded satisfactorily to treatment with ketoconazole. The finding of candidial

infection in this adolescent with diabetes mellitus is not surprising as other investigators have reported a similar finding<sup>20</sup>. The increased frequency of vaginal candidiasis in patients with diabetes mellitus is believed to be due to increase in ambient vaginal glyco-gen stores in them<sup>20</sup>.

In conclusion, the prevalence and incidence of asymptomatic bacteriuria do not differ between diabetic and non-diabetic children and adolescents.

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