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Urinary abnormalities in asymptomatic secondary school children in Calabar, Nigeria

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Abstract: *Introduction:* Many patients with kidney disease are asymptomatic but may have abnormalities in urine. The aim of this study was to determine the prevalence of urinary abnormalities (UA) in asymptomatic secondary school children in Calabar, Nigeria and its relationship with age, sex, social class, body mass index and blood pressure.
Methodology: It was a descriptive cross sectional study of 407 apparently healthy secondary school children aged 10-18 years recruited by multistage sampling techniques in June-July, 2022. Semi-structured questionnaires were used to obtain their bio-data and clinical history. Subject's height and weight were measured using a stadiometer and body mass index (BMI) calculated. Blood pressure of each subject was measured using auscultatory method. Early morning urine was obtained from each subject and urinalysis done using dipstick-combi 10. The result of urinalysis was recorded. Data were analyzed using SPSS version 22.0 and *p*-value ≤ 0.05 was significant.
Results: Out of 407 participants, 162 (39.8%) were males and 245 (60.2%) females giving a M:F ratio 1:1.5. The mean age was 13.5 ± 1.9 years. The prevalence of urinary abnormalities was 115 (28.3%) with many having more than one abnormality. Age group 13-15years were more commonly affected. Nitrituria 75(18.4) was the most frequent urinary abnormality followed by proteinuria 38 (9.3%), leucocytes14 (3.4%) andhaematuria 5(1.2%). There was no glucosuria. Nitrituria was statistically significant among females (p=0.040). Blood pressure, overweight and obesity were not statistically significant in relation to urinary abnormalities.
Conclusion: The prevalence of urinary abnormalities was high among secondary school children but commoner in females and mainly nitrituria, proteinuria, leucocytes and haematuria. We therefore recommend regular screening for urinary abnormalities among secondary school children in our environment for early detection and prevention of renal diseases.

Keywords: Urinary abnormalities, urinalysis, dipstick, secondary school children.

Introduction

Most patients with kidney diseases are initially asymptomatic despite having urinary abnormalities. Early detection of these diseases would be achieved by screening asymptomatic children for urine abnormalities such as proteinuria, haematuria, leucocytes and nitrite by conducting urinalysis.[1,2]
Prevalence of urinary abnormalities in asymptomatic Nigerian children ranges from 3.8 to 29.8%.[3-12]
Majority of these Nigerian studies were done among primary school children aged 5 to 12 years.[3,6,7,9-12]There were very few studies on urinary abnormalities among secondary school children, who are mainly adolescents, aged 13-18years.[4,5,8] In addition, these studies [9,11] in our immediate environment Calabar, concentrated on proteinuria and did not look at other urinary abnormalities. This work will help in knowing the burden of these urinary abnormalities in our environment. In Asia, an official programme involving annual screening of school children for urinary abnormalities is regularly conducted in Japan[13], Taiwan[14] and Korea[15] with early detection and intervention reducing prevalent rates of common kidney diseases in these countries. In Nigeria, there are no such official screening programmes as this has not been integrated in the school health programme. Therefore, this study will enable government and non-governmental organizations in planning and strategizing for such annual screening which will enhance the school health programme in the country.

Methodology

Study area

The study was conducted in Calabar municipal area council of Cross River State, South-South geopolitical zone of Nigeria. The population of the area during the 2006 census was 183,681.[16] The inhabitants are predominantly Efiks, Ibibios, Ejaghams and other ethnic groups. Their occupation ranges from civil service, trading, military and paramilitary to general works of life. Government secondary school, Akim Qua which is one of the large public secondary schools in the area with population of 1,300 students was selected for the study.
Study design: It was a descriptive cross sectional study.
Eligibility criteria: Inclusion criteria were subjects whose parents/ guardian gave consent, and completely filled the questionnaire.

Exclusion criteria included children with symptoms suggestive of renal disease (facial or leg swelling, past history of facial or leg swelling, pain on passing urine, frequent passage of urine, urgency in passing urine and haematuria), Subjects who were noted to be febrile within two weeks preceding the study. Female subjects who were menstruating as this may affect the urinalysis result and children with features suggestive of sickle cell disease (recurrent yellowness of the eyes, bone pain and frequent blood transfusion).

Sample size

The minimum sample size was calculated using the formula.[17]
$n=Z^2pq/d^2$. Where n = desired sample size (when population >10,000), Z = the standard normal deviation (usually set at 1.96), p = the proportion in the population with attribute to previous study(50%) due to lack of similar study among secondary schools in the area. q= 1.0- P=1.0-0.50 = 0.5, d = degree of accuracy desired (0.05)

The minimum sample size was 384, but with addition of 10% probability of non-response it amounted to 422.
Sample technique
Multistage sampling method was used, which involved three stages. Stratified random sampling was used in the first and second stages while simple random sampling was used in the third stage.
First stage: In this stage, the school was stratified based on classes (ie JSS1, 2, 3 and SS1, 2, 3). One sixth of the sample size was equally allocated to each class.
Second stage: For this stage, each class was stratified based on streams (i.e A, B, C, etc). The number of children to be recruited from the class was equally allocated among the streams. In any class without streams, the whole class was chosen.
Third stage: This was the final recruitment of a child from a particular stream. Serial numbers of pupils in the class register was used. From the class register, a table of random numbers was used to select participants. It ensured that any child in the school can be recruited. Where a subject that was picked using the table of random numbers is not available in school for any reason or did not satisfy the inclusion criteria, such was dropped and the next random number on the statistical table of random numbers was taken. If a random number was chosen and it did not correspond to the serial number in the class registers, the number was discarded. The process was continued until the sample size was met for each class. Letters of introduction, consent form for parents/ guardians to enlist their children into the study and assent form for participants were distributed among the selected children.

Method of data collection

Semi-structured questionnaire was used to obtain records of subjects' biodata (name, age, gender), parents' educational status and occupation, history of facial or leg swelling, fever in the previous two weeks, pain on passing urine, frequent passage of urine, urgency to pass urine and sometimes wets pant before getting to the toilet, bed wetting, passage of blood in urine, current menstruation for girls that have attained menarche, history suggestive of sickle cell disease (recurrent yellowness of eyes, bone pain, frequent blood transfusion) and if child was a known diabetic. The questions were simple, clear and easy for parents to understand without explanation. The subjects' weight, height, body mass index and blood pressure were recorded. The blood pressures were measured following the recommendations of the National High Blood Pressure Education Programme Working on High Blood Pressure in children and Adolescents fourth report.[18] The Body Mass Index (BMI) number was plotted against age on the WHO BMI-for-age growth chart (for boys or girls) to obtain a z-score. The z-score indicated the relative position of the child's BMI number among children of the same sex and age. BMI-for-age categories and the corresponding z-scores were recorded.[19] Subjects were stratified into upper, middle and lower social classes based on their mothers' level of education and fathers' occupation as described by Olusanya et al.[20]

Procedure of urine dipstick testing

Each subject recruited was given a clean urine bottle which was properly labeled with his/her serial number to take home. They were instructed on how to carefully void 10mls of their first morning urine at home (collected at mid-stream) into the bottle, and bring same to school the same morning. The collected specimens were tested promptly with dipstick combi-10 urinalysis strip (Combi-Uriscreen 10SL Axiom Medical Ltd, UK, 2022, LOT NO: 56140218) by completely immersing it into the urine for 2-3 seconds. The colour change for each patch on the strip was compared to a control on the outside of the strip container and result was recorded within 60 seconds following immersion in the urine.[21] The results were read by the investigators. One or two investigators were assigned to do these to avoid inter-observer errors.

Ethical consideration

Ethical approval for this study was obtained from the Health Research Ethics Committee, Ministry of Health, Cross River State, Nigeria. Permission was obtained from the school authority. Written consent was obtained from the parents/guardians of the participants and assent was obtained from each of the participant.

Data analysis

Data collected using the semi-structured questionnaire were checked for accuracy and entered into Statistical Package for Social Sciences (SPSS) version 20.0, 2011 and were analysed with the same software. Descriptive statistics such as frequencies and percentages, means, standard deviations, and mode were computed. Inferential statistics such as chi-square test and Fisher's exact test were computed. All analysis was done at a 95% level of significance, *p* value $\leq$ 0.05.

Results

A. Socio-demographic characteristic of study population

Four hundred and seven subjects consisting of 162 (39.8%) males and 245(60.2%) females with a male to female ratio of 1:1.5, Mean age was 13.5 ±1.9 yrs with age range from 10-18 years. (table 1).

Table 1: Socio-demographic characteristics

Variables	Frequency (n)	Percentage (%)
Age group (years)		
10-12	133	32.7
13-15	204	50.1
16-18	70	17.2
Sex		
Male	162	39.8
Female	245	60.2
Social class		
Upper	100	24.6
Middle	254	62.4
Lower	53	13.0

B. Prevelance of urinary abnormalities

Fig 1: The prevalence of urinary abnormalities was 28.3%.

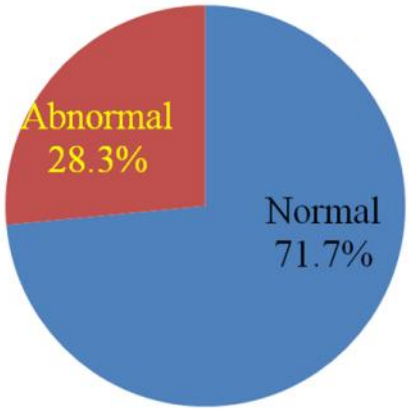

Table 2: Prevalence of Individual Urinary Abnormalities

Variables	Normal urinalysis n (%)	Abnormal urinalysis n (%)
Bilirubin	403(99.0)	4(1.0)
Urobilinogen	401(98.5)	6(1.5)
Ketones	406(99.8)	1(0.2)
Glucose	407(100.0)	0(0.0)
Proteinuria	369(90.7)	38(9.3)
Haematuria	402(98.8)	5(1.2)
Nitrite	332(81.6)	75(18.4)
pH	406(99.8)	1(0.2)
Specific gravity	405(99.5)	2(0.5)
Leucocytes	393(96.6)	14(3.4)

C. Age group, sex, social class and urinary abnormalities

Table 3a: Age Groups, Sex, Social Class & Urinary Abnormalities

Variable	Normal Urinalysis n(%)	Abnormal Urinalysis n(%)	Total n (%)	*p*-value
Age Group(Yrs)				
10-12	99(24.3)	34(8.4)	133(32.7)	0.546
13-15	146(35.9)	58(14.2)	204(50.1)	
16-18	47(11.5)	23(5.7)	70(17.2)	
Sex				
Male	129(31.7)	33(8.1)	162(39.8)	0.004***
Female	163(40.0)	82(20.2)	245(60.2)	
Social class				
Upper	76(18.7)	24(5.9)	100(24.6)	0.619
Middle	178(43.7)	76(18.7)	254(62.4)	
Low	38(9.3)	15(3.7)	53(13.0)	

***Urinary abnormalities were commoner and statistically significant among females (Table 3a)

D. Blood pressure, BMI categories and urinary abnormalities

Table 3b: BMI Categories, Blood Pressure & Urinary Abnormalities

Variables	Normal Urinalysis n(%)	Abnormal Urinalysis n(%)	Total n (%)	*p*-value
BMI Categories				
Thinness	11(2.7)	3(0.7)	14(3.4)	0.960
Normal	259(63.6)	104(25.6)	363(89.2)	
Overweight	20(4.9)	8(2.0)	28(6.9)	
Obesity	2(0.5)	0(0.0)	2(0.5)	
Blood pressure				
Normal	287(70.5)	111(27.3)	398(97.8)	0.278
High	5(1.2)	4(1.0)	9(2.2)	

E. Age in relation to proteinuria, haematuria, leucocyte and nitrite

Table 4: Age in relation to Proteinuria, Haematuria, leucocyte and Nitrite in the study

Variables	10-12yrs	13-15yrs	16-18yrs	*p*-value
Proteinuria				
Positive	14(3.4)	20(4.9)	4(1.0)	0.732
Negative	119(29.2)	184(45.2)	66(16.2)	
Haematuria				
Positive	0(0.0)	4(1.0)	1(0.2)	0.847
Negative	133(32.7)	200(49.1)	69(17.0)	
Nitrite				
Positive	19(4.7)	40(9.8)	16(3.9)	0.270
Negative	114(28.0)	164(40.3)	54(13.3)	
Leucocytes				
Positive	3(0.7)	6(1.5)	5(1.2)	0.188
Negative	130(31.9)	198(48.7)	65(16.0)	

***Nitrite was commoner in females than males and was statistically significant (P=0.040) Table 5a

F. Sex and social class in relation to Proteinuria, Haematuria, Leucocyte and Nitrite in the study

Table 5a: Sex in Relation to Proteinuria, Haematuria, Leucocyte and Nitrite in the study

Variables	Male n (%)	Female n (%)	Total n (%)	*p*-value
Proteinuria				
Positive	10(2.4)	28(6.9)	38(9.3)	0.203
Negative	152(37.4)	217(53.3)	369(90.7)	
Haematuria				
Positive	0(0.0)	5(1.2)	5(1.2)	0.895
Negative	162(39.8)	240(59.0)	402(98.8)	
Nitrite				
Positive	22(5.4)	53(13.0)	75(18.4)	0.040***
Negative	140(34.4)	192(47.2)	332(81.6)	
Leucocytes				
Positive	3(0.7)	11(2.7)	14(3.4)	0.177
Negative	159(39.1)	234(57.5)	393(96.6)	

Table 5b: Social Class in Relation to Proteinuria, Haematuria, leucocyte and Nitrite

Variables	Upper Class n (%)	Middle Class n(%)	Lower Class n (%)	Total n(%)	*p*-value
Proteinuria					
Positive	8(2.0)	24(5.9)	6(1.5)	38(9.4)	0.169
Negative	92(22.6)	230(56.5)	47(11.5)	369 (90.6)	
Haematuria					
Positive	1(0.2)	3(0.8)	1(0.2)	5(1.2)	0.533
Negative	99(24.3)	251(61.7)	52(12.8)	402 (98.8)	
Nitrite					
Positive	16(3.9)	50(12.3)	9(2.2)	75 (18.4)	0.769
Negative	84(20.6)	205(50.4)	43(10.6)	332 (81.6)	
Leucocytes					
Positive	4(1.0)	10(2.4)	0(0.0)	14(3.4)	0.403
Negative	96(23.6)	244(60.0)	53(13.0)	393 (96.9)	

Discussion

In this study, the prevalence of urinary abnormalities (UA) was 28.3%. This finding was similar to the study by Isezuo et al[8] in Sokoto, Nigeria and Alharti et al[22] in western Saudi Arabia. This high prevalence found should inform larger scale study on urine abnormalities in our environment involving more schools to evaluate the burden of this condition. This will enable early diagnosis and treatment of urinary abnormalities among secondary school children. Surprisingly, a study in Benin reported lower prevalence of 5.25% in secondary school children.[5]

Urinary abnormalities were commoner in females. This was consistent with studies by Zhong et al [23] in China and Oviasu et al[5] in Nigeria. However, Lin et al[13] found UA to be more in males than females. The reason for this difference between males and females is unclear.

Urinary abnormalities were more in age group 13-15 years, though not statistically significant. Higher prevalence was reported among similar age group in China.[23] The predominance of UA among the age group 13-15years in this study may be explained by age-related variation in the pattern of kidney disease globally. A study in Enugu has demonstrated predominance of CKD in children 10 years and above and there is also evidence of CKD increasing with age.[24,25] This reflect the possibility of acquired aetiological factors like infections in this age group. This further strengthens the need for routine urinary screening at entry points into primary and secondary schools.

Urinary abnormalities (UA) were found more in the middle and lower social class. This was similar to study by Hagar et al.[26] Low socio-economic factors including poor education, low income and poor access to healthcare are strong predictors for CKD.[27]

There was no significant finding between blood pressure and UA in this study, as most subjects had normal blood pressure. Abnormal diastole blood pressure was reported in a cohort of asymptomatic Nepalese School children[28] and hypertension was common in subjects with UA in study done in India.[29] The four subjects with high blood pressure and urinary abnormalities were referred to the University of Calabar Teaching Hospital, Calabar, Nigeria for further evaluation but were lost to follow-up. Hypertension with UA is an associated predictor of kidney disease in our environment.[4,30]

Most subjects with UA in this study had normal body mass index (BMI). Among the 28 overweight children, only 8 (2%) had abnormal urinalysis while none of the two obese children had abnormal urinalysis. Overweight and obesity though not common in this study, are important predictors of renal diseases.[4,] Hence, the need for this screening study in a larger population.

Nitrituria was the most common UA in this study with a prevalence of 18.4%. It was similar to the result from a study in western Saudi Arabia[31] but lower prevalence of

0.69%, 1.5% were reported in Nigeria and Iran respectively.[6,32] The finding of nitrituria in this study may raise the suspicion of urinary tract infections (UTI). However, urine microscopy, culture and sensitivity were not done which was a limitation in this study. The sensitivity and specificity of nitrite test has been reported to be 49% and 93% respectively[33], with a combination of nitrite and leucocyte esterase increasing sensitivity to 98%.[34] In this study prevalence of leucocyte esterase was 3.4%. Subjects with nitrituria should receive further evaluation to confirm diagnosis of UTI. This will mitigate complications of UTI.

Nitrituria was significantly higher in females than males, consistent with findings by other workers. [6,10] This is probably due to shorter urethra, proximity of urethra to anus in females which increase susceptibility to ascending infection. Nitrituria is commoner in age group 13-15years though not significant. The period of adolescent is associated with risky behavior and increase in sexual activity, increasing risk for infection and sexually transmitted diseases.

The prevalence of proteinuria was 9.3% in this study, however, lower prevalence rate of 1% and 1.6% had being reported in Port Harcourt and Calabar both in Sourthern Nigeria respectively,[11,12] while a higher prevalence was reported by Jari et al[35] in Iran. This result in this study, may be due to one point in time measurement of urinary abnormality compared to the other studies[11,12] carried out in the same area.

Proteinuria was more in females than male (though not statistically significant) and this is similar to other studies,[11,35]but in contrast to a study in Egypt where age or sex had no impact on proteinuria.[36] The female preponderance may possibly be explained by female genital tract contamination and higher predisposition for asymptomatic bacteruria in females.

Haematuria was found in 1.2%children in this study, this is similar to the finding in Port Harcourt, Nigeria.[12] However, El sharif et al[37] in Sudan reported a higher rate of 9.4% which was ascribed to schistosomiasis. Schistosomiasis is not a common environmental problem in our setting. This may suggest the presence of underlying renal diseases in the five children and they were referred.

Conclusion

In conclusion, urinary abnormality (UA) is common among asymptomatic children with Nitrituria being the most prevalent and significant in females. Hence, screening school children especially will help in early detection and prompt treatment thereby reducing the prevalence of renal diseases.

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