Original Article

PROTEINURIA AND HAEMATURIA IN APPARENTLY HEALTHY PRIMARY SCHOOL CHILDREN IN ENUGU, NIGERIA.

[1]Chime Paschal U, [1]Muoneke Uzoamaka V, [2]Una Alfred F,[1]Mbanefo Ngozi R,[1]Bisi-Onyemaechi Adaobi .I, [1]Igbokwe Obianuju O.
[1]Department of Paediatrics University of Nigeria, Enugu Campus. Enugu, Enugu State, Nigeria
[2]Department of Community Medicine, College of Medicine, Ebonyi State University, Abakaliki/Federal Teaching Hospital, Abakaliki, Ebonyi State, Nigeria

ABSTRACT

Background:
Mass screening for proteinuria and haematuria is advocated, especially in resource-poor countries with non-existent health insurance policy, to enhance awareness of renal diseases. This screening increases the chance for early detection and treatment, which in turn reduces incidences of resultant kidney failures.
Objective:
To determine the prevalence of asymptomatic proteinuria and haematuria in apparently healthy primary school children in Enugu.
Methodology:
This was a cross-sectional descriptive survey involving apparently healthy primary school children in Enugu, aged 6 to 12 years, conducted from January 2018 and March 2018 through a pre-tested, caregiver administered questionnaire. Subjects were clinically examined, and samples of on-the-spot mid-stream urine collected from each participant for dipstick urinalysis. The data obtained were analyzed using the Software Package for Social Science (SPSS) version 22 for Windows.
Results:
One thousandchildren comprising, 437 (44%) males and 563 (56%) females were selected with an age range of 6 to 12 years and a mean of 10.13 ± 1.81 years. A total of 190(19%) urinary abnormalities were noted existing as isolated proteinuria, isolated haematuria or as a combination of both. These urinary abnormalities were more in the females, higher among the early adolescents (9-12 years) with proteinuria predominating.
Conclusion:
Asymptomatic urinary abnormalities can easily be detected early in the course of renal disease development. A urine dipstick is an important tool in the screening program for everybody, including children of school age. It is important that screening programs be organized for these children at regular intervals and those with positive findings referred immediately for appropriate management.
Keywords: Proteinuria, Haematuria, Primary school children, Prevalence.
Running title: Proteinuria and haematuria in school-aged children in Enugu

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INTRODUCTION

Basic dipstick method is the most common screening procedure for early detection of renal or urinary tract diseases in apparently healthy subjects as serious renal diseases may be present without any symptoms.[1]It is a simple and inexpensive test and is the cornerstone in the evaluation of the kidney function.[2] The test dates back to 1973, when a urine screening program for the early diagnosis of chronic kidney disease (CKD) was introduced and performed in Japan.[3] Similarly, a compulsory urine screening program has been introduced performed in primary school children at both entry and exit stages in Korea since 1998 to identify CKD at an early stage.[4]

Correspondence to :
Dr. Muoneke V.U
Department of Paediatrics
College of Medicine
University of Nigeria/University of Nigeria Teaching Hospital Enugu,
Enugu State, Nigeria.
Email:vizym@yahoo.com

Renal diseases are increasingly common causes of childhood morbidity and mortality and some of these diseases, if undetected, and not treated early, may lead to debilitating chronic disease (CKD) which is difficult and controversial to screen in terms of the best type of screening method to be used and the possible outcome of early intervention.[2] Again, this is because there is uncertainty whether early detection of renal disorders in childhood will lead to effective interventions and reduction in the number of individuals who develop the end-stage renal disease (ESRD). On the contrary, investigators in Japan, Taiwan and Korea have documented that screening programs have led to early detection and effective intervention of renal pathologies among their patients.[5] However, the researchers from Europe and North America have a contrary view.[6] There are considerable differences in the pattern of renal disease around the world which arise from racial variation in the susceptibility to renal disease, compounded with socioeconomic factors.[7] Congenital causes are responsible for the greatest percentage of cases of CKD seen in children. Although, this is the most common reported aetiology from developed countries, infectious or acquired causes predominate in developing countries where patients are referred out to hospitals in the later stages of kidney disease.[8]

Proteinuria and less commonly, haematuria may manifest early in the course development of renal or urinary tract disease.[9] Proteinuria can be classified into (a) glomerular proteinuria (b) tubular proteinuria and (c) overflow proteinuria.[10] Transient proteinuria is usually associated with exercise, stress, fever and dehydration. It does not reflect renal disease.[11] Persistent Proteinuria most often leads to renal injury and should, therefore, be thoroughly investigated.[12]

Haematuria can either be visible to the naked eyes (gross) or apparent only upon urinalysis (microscopic). Microscopic haematuria may be discovered as an accidental finding on a urinalysis prompted by urinary or other symptoms.[13] Haematuria can be transient due to fever, infections, trauma and exercise and are usually microscopic and benign.[14] Persistent haematuria usually indicates renal disease.[14]

Knowing that renal diseases may often appear asymptomatic and only noticed during routine investigations, it becomes pertinent to investigate for the presence of any renal disorder in children as early as possible. This can only be achieved by the use of the very affordable and reliable urine dipstick screening programme that easily detects both proteinuria and haematuria early. The advantages include the fact that it enhances awareness of renal diseases, increases the chance for early detection and treatment which in turn reduces incidences of resultant kidney failures since the standard treatment of renal replacement therapy in these resource-poor countries especially in Nigeria is neither easily accessed nor affordable.

Our study was thus aimed at determining the prevalence of asymptomatic proteinuria and haematuria among apparently healthy primary school children in Enugu, Enugu State using the early urine dipstick screening test. It is hoped that information obtained would aid in providing effective and affordable interventions in children with renal diseases at the early stages: the target is to reduce the incidences of chronic kidney disease and subsequently end-stage renal disease.

Methods

This was a descriptive cross-sectional study of apparently healthy primary school children between 6 and 12 years old in Enugu-South, Enugu State, Nigeria. The study was carried out between January and March 2018. Approval to conduct the study was obtained from the ethical committee of the University of Nigeria Teaching Hospital Ituku/Ozalla, Enugu and permission from the authorities of the Local Government Education Commission and the heads of the selected schools. Informed consent was obtained from the parents/guardians of selected pupils.

Study population

A total of 110 primary schools in Enugu South LGA are officially registered with a population of 22,375 children comprising 11,053 males and 11,322 females[33] from where the study subjects aged 6 to 12 years were selected. Of this number of primary schools, 11 was selected using a proportionate sampling outcome of 10%[34] and also selected by simple random sampling method. Each of the selected schools had 6 classes: classes 1 to 6 with each class comprising of 2 arms. An arm was chosen by simple random sampling method to represent each class.

The sample size of 1000 was calculated using the formula for a cross-sectional survey.[15]The calculated sample size was allocated proportionately to the schools selected using the Neymann proportional allocation formula without gender stratification.[35]

More than five visits were made to each of the 11 selected schools; the first was to get approval from the School authorities and introduce the researcher, the study objectives and design. The second was to give brief lectures on urinary abnormalities and select the subjects, the 3rd to obtain parental consent from each of the selected subjects while the rest was to collect urine samples for analysis.

A female nurse was recruited and repeatedly trained on general sample collection by the researcher who equally carried out a complete physical examination on all the selected subjects.

Mid-stream urine samples were collected after proper genital cleaning on 3 different occasions at 1 weekly interval at exactly 8.00 am each day to exclude the further influence of orthostatic proteinuria on the outcome of the test. The urine samples were tested with the Medi- Test Combi 9 multistick (Macherey-Nagel, Duren, Germany) for proteinuria and haematuria.[16] The urine findings were recorded, and proteinuria and haematuria of 1+ or more were considered significant. Children who had significant proteinuria and/or haematuria were referred to the Paediatric Nephrology clinic at the University of Nigeria Teaching hospital Ituku-Ozalla, Enugu for further evaluation and management. However, further follow-up data were not included in the analysis of this study.

Exclusion Criteria

1. Subjects with certain illness that may cause proteinuria and/or haematuria such as sickle cell anaemia, nephrotic syndrome
2. Subjects who were noted to be febrile
3. Female subjects who were menstruating as this may affect the urinalysis result
4. Subjects whose parents did not give consent

Statistical Analysis

The data obtained was recorded on the study proforma and entered into the computer and analyzed using the Software Package for Social Science (SPSS) version 22 for Windows. Data collated were summarized using frequency and percentages. Association between categorical variables was analyzed using chi-square, and logistic regression and the statistically significant result was attained wherever a p-value was less than the significance level of 0.05.

Results

Demographic Characteristics of the Study Population

A total of 1000 apparently healthy children were enrolled in the study which was carried out from 15th January 2018 to 18th March 2018. Four hundred and thirty-seven (44%) were males, while 563 (56%) were females. The age range was 6 to 12 years, with a mean ± standard deviation (SD) of 10.13 ± 1.81 years. Generally, there was female gender predominance across all age groups except for the 6-year-olds, but this was not statistically significant. ($\chi^2 = 2.551$, $p = 0.863$). All the male subjects were circumcised, had normal urethral orifice with normal urinary stream. Table 1 shows the demographic characteristics of the study population.

The prevalence of Urinary Abnormalities in the Study Population

Out of 1000 school children screened, majority 810(81%) had no urinary abnormalities observed, while 190 of the subjects had either proteinuria or haematuria giving a prevalence of 19%, 160 (16%) pupils had isolated proteinuria, 20 (2%) pupils had isolated haematuria while only 10 (1%) of them, all females, had combined proteinuria and haematuria. Of those with combined pathologies,7 were 12-year-olds, 2 were 11 years, and the remaining one was 8 years old.

The Gender Distribution of Children with proteinuria

Table 2 shows the gender distribution of children with proteinuria. Of the 170 children with proteinuria, 105 (61.8%) were females and 65 (38.2%) males with a male-female ratio of 1:1.6. The gender-specific prevalence of proteinuria in females was 18.7% (105/563) while that of males was 14.9% (65/437). The prevalence of proteinuria did not differ significantly between females and males. ($\chi^2 = 2.486$, $p = 0.115$)

The Age Distribution of Children with proteinuria

Table 3 shows the prevalence of proteinuria in the early adolescent group (9 to 12 years) was 15.9% (127/797) while the prevalence of 21.2% (43/203) occurred in the preadolescent group (6 to 8 years), but the prevalence of proteinuria between these two age groups was not statistically significant. ($\chi^2 = 3.157$, $p = 0.076$).

The Gender Distribution of Children with haematuria

Table 4 shows the gender distribution of children with haematuria. Thirty children were noted to have haematuria, out of which 18 (60.0%) were females, and 12 (40.0%) were males with a male-female ratio of 1:1.5. The gender-specific prevalence of haematuria in females was 3.2% (18/563) while that of males was 2.7% (12/437). The prevalence of haematuria did not differ significantly between females and males. ($\chi^2 = 0.172$, $p = 0.678$).

The Age Distribution of Children with haematuria

Table 5 shows the prevalence of haematuria in the early adolescent group (9 to 12 years) was 3.1% (25/797) while prevalence of 2.5% (5/203) occurred in the preadolescent group (6 to 8 years), but the prevalence of proteinuria between these two age groups was not statistically significant. ($\chi^2 = 0.252$, $p = 0.659$).

Discussion

The major problem in the practice of nephrology in developing countries is how to map out ways and strategies in detecting early urinary abnormality for those at risk of developing chronic kidney disease (CKD) later in life. This is because many renal and urinary tract disorders may be asymptomatic for a long period, and routine urine screening programs are recommended as a basic fundamental step in early identification of renal damage.

The prevalence of asymptomatic urinary abnormalities (proteinuria or haematuria) in school children in this study was 19%. This is comparable to the study by Fouad*et al*[17] who documented a prevalence of 13%. The percentage of urine abnormality in this study is however higher than the prevalences of 3.8%, 6.0% and 9.6% cited by Abdurrahman *et al*[18] in 1978, Dodge *et al*[19] in 1976 and Akor*et al*[20] in 2009. The low prevalences documented by the first two authors may be due to the fact that their studies were done some decades ago when school sanitation programs were rigidly enforced. Though the prevalence of 9.6% by Akor*et al*[20] is higher than that from Abdurrahman *et al*[18] and Dodge *et al.,*respectively[19] it remains lower than what obtained in our study. This could be attributed to the fact that the study selected only the apparently healthy new school entrants while ours involved all apparently healthy primary school children within the age range of 6-12 years who satisfied the inclusion criteria.

Proteinuria occurred more than the other urinary abnormalities in this study with a prevalence of 16%. This prevalence was quite higher when compared to other studies[18,20,22,] and the reason could be attributed to orthostatic proteinuria from the use of random midstream urine samples or from a possibly increased prevalence of asymptomatic bacteriuria in Enugu. It has been documented that gross bacteriuria or asymptomatic bacteriuria could contribute to the false-positive result of protein in urine.[21] Akor*et al*[20] documented a prevalence of 3.5% in Jos using 650 primary school children, and Abdurrahman *et al*[18] documented 3.6% as their proteinuria prevalence in Kaduna using 600 school children while Ikimaloet *al*[22] in Port Harcourt reported a much lower proteinuria prevalence of 1% in their study. The lower prevalence reported in these studies[18,20,22] may be due to the fact that they used a smaller population as well as using early morning urine which removed the influence of orthostatic proteinuria on the urinalysis result.

This study shows that proteinuria occurred more among the females than the males, although this was not statistically significant. This was similar to the studies by Abdurrahman *et al*[18] and Akor*et al*[20] but contrasted with other studies by Elsharif*et al*[23] and Onifade*et al*[24] where males predominated. This finding might have resulted from contamination from the female genital tract.

There was no statistically significant difference in the prevalence of proteinuria across the two age groups: 6 to 8 years old and the 9 to 12 years old in this study. Nonetheless, the higher rate of proteinuria was found in the 9-12 years group. This observation is similar to the findings by Elsharif*et al*[23] and Jafar*et al*[25,] who recorded higher proteinuria prevalence in the same age group. The higher prevalence of proteinuria in this age group may not be unconnected with the fact that this age group represents the early adolescent period and may have been sexually exposed predisposing them to asymptomatic bacteriuria.[26]

The prevalence of 2.0% for haematuria obtained in this study is similar to the study by Akor*et al*[20] in Jos in 2009 and Akinkugbe*et al*[24] in Ibadan in 1988 who documented a prevalence of 1.5% and 2.6% respectively. Just like this study, Akor*et al*[20] enrolled apparently healthy primary school pupils. In contradistinction, some studies have reported haematuria prevalence rates higher than that obtained in the present study. Abdurrahman *et al*[18] in Kaduna in 1978 and Elegbe*et al*[28] in Ile-Ife in 1987 found a prevalence of 3.2% and 3.9% respectively among apparently healthy primary school children. Elsharif*et al*[23] in Sudan in 2015 documented a much higher prevalence of 9.4% in their study. The high prevalence in Sudan was attributed to Schistosomiasis. On the other hand, studies from Malaysia[29], Egypt[30] and China[31] documented lower prevalences for haematuria of 0.21%,[29] 0.36% [30] and 0.46%[31] respectively. The lower prevalences in these studies may be attributed to a high level of sanitation practised at the primary school level in these countries.

In the present study, haematuria was commoner in females than in males, though the difference was not statistically significant. The observed trend is in tandem with the finding contained in the study done by Elsharif*et al*[23].

This study did not show any statistically significant difference in the prevalence of haematuria across the two age groups (6-8 years vs 9-12 years). Nonetheless, the higher prevalence of haematuria was found in the 9-12 years group. This observation is similar to the findings of Elsharif*et al*[23] who recorded higher haematuria prevalence in the 10-12 years group. This age group is noted to be adventurous and ambulant and may have been in contact with stagnant water infested with Schistosoma eggs/worms.

The prevalence of combined haematuria and proteinuria was 1%in this study and is comparable to the study by Vehaskari*et al*[32,] who reported a prevalence of 0.7%. School children with such a combination are more likely to have significant renal disease and may require further evaluation.[36]The simultaneous occurrence and persistence of these two abnormalities has been shown to be a significant predictor of end-stage renal disease.[37]

Study limitation

Though the study was more of a prospective type, microscopic examination of the urine should have been included in the study to further confirm the actual presence of haematuria in these children.

Factors/ conditions such as asymptomatic bacteriuria which may result in false positivity or false negativity for either proteinuria or haematuria should have been explored further.

There was a lack of further follow-up of the subjects with positive findings even after they were referred to the Nephrology Unit of the Teaching Hospital.

Conclusion

In conclusion, proteinuria and haematuria remain an important problem in school children. However, further work-up should be carried out to find out the exact aetiology of any abnormal findings. The prevalence of proteinuria and haematuria in Enugu were 16% and 2% respectively and were commoner in children aged 9-12 years with more females affected.

On account of these urinary findings, there is need therefore for regular screening of school children at least twice a year in addition to carrying out other relevant renal tests, may help detect early, those at possible risk of developing kidney disease.

TABLES

Table 1: **Demographic Characteristics of the Study Population**

Age (years)	Male n (%)	Female n (%)	Total n (%)
6	22 (5.0)	20 (3.6)	42 (4.2)
7	22 (5.0)	40 (7.1)	62 (6.2)
8	38 (8.7)	60 (10.7)	98 (9.8)
9	62 (14.2)	73 (12.9)	135 (13.5)
10	85 (19.5)	105 (18.6)	190 (19.0)
11	63(14.4)	65 (11.6)	128 (12.8)
12	145 (33.2)	200 (35.5)	345 (34.5)
Total	437 (100.0)	563 (100.0)	1000 (100.0)

$\chi^2 = 2.551$, $p = 0.863$

Table 2: Distribution of proteinuria by Gender

Variables	**Proteinuria**				
	No	Yes	Total	χ^2	p-value
	n (%)	n (%)			
Gender					
Male	372 (85.1)	65 (14.9)	437		
				2.486	0.115
Female	458 (81.3)	105 (18.7)	563		
Total	830 (83.0)	170 (17.0)	1000 (100)		

Table 3: Distribution of proteinuria by Age.

	Proteinuria				
Age Group (years)	No	Yes	Total	χ^2	p-value
	n (%)	n (%)			
6 – 8	160 (78.8)	43 (21.2)	203		
				3.157	0.076
9 – 12	670 (84.1)	127 (15.9)	797		
Total	830	170	1000		

Age grouping based on the average ages of primary school children in Nigeria, 6-8yrs representing the junior students and the other being senior students.

Table 4: Distribution of Haematuria by Gender.

	Haematuria				
	No	Yes	Total	χ^2	p-value
	n (%)	n (%)			
Gender					
Male	425 (97.3)	12 (2.7)	437		
				0.172	0.678
Female	545 (96.8)	18 (3.2)	563		
Total	970	30	1000		

Table 5: Distribution of Haematuria by Age

	Haematuria				
	No	Yes	Total	χ_2	p-value
	n (%)	n (%)			
Age Group					
6-8yrs	198 (97.5)	5 (2.5)	203		
				0.252	0.659
9-12yr	772 (96.9)	25 (3.1)	797		
Total	970	30	1000		

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