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ORIGINAL RESEARCH

Prevalence, pattern and determinants of urine abnormalities among school pupils in a semi-urban community

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Abstract

Background: Dipstick urinalysis is a semi-quantitative examination of the urine, which can be utilized as a screening and diagnostic tool in children. It is rapid, sensitive, easy to perform and affordable for the resource-poor environment.

Objectives: To describe the pattern of urinalysis findings using urinary dipsticks and the determinants of urine abnormality among pupils in primary schools in a semi-urban area.

Methods: Apparently healthy 387 pupils were recruited from 10 public and 5 private primary schools in Ikenne Local Government Area of Ogun State, Nigeria using multi-stage and proportionate sampling techniques. Data on demography, nutritional status and urinary examination were obtained using Interviewer-administered questionnaires, clinical examination and dipstick urinalysis respectively.

Results: Dipstick urinalysis revealed the following; urine pH and specific gravity were normal in 98.2% and 100.0% of the pupils respectively. Protein, leukocyte esterase, nitrite, bilirubin, urobilinogen, blood and ketones were detected in 18.1%, 15.8%, 14.2%, 3.3%, 2.1%, 0.8%, and 0.5% respectively. Glucose and ascorbic acid were generally absent in the urine samples. Female gender significantly contributed to the pattern of urinalysis (leukocyte esterase and nitrites). Proteinuria was most frequent among the underweight (38/70; 54.3%). Urine abnormalities were more prevalent among pupils in public schools compared with private schools though not statistically significant, and not influenced by gender.

Conclusion: Asymptomatic proteinuria and urinary tract infection are not uncommon among children. Female gender and socio-economic status play a role in the incidence of the conditions.

Keywords: Children, Dipsticks, Proteinuria, Semi-Urban Community, Urinalysis

Introduction

Dipstick urinalysis (UA) is a rapid diagnostic test commonly carried out at the point of care for the evaluation of diseases of the kidneys and urinary tract. [1] It is a semi-quantitative method

of urinary examination, which can predict renal and genitourinary diseases. Information derived from dipsticks urinalysis can also serve as a guide to further medical assessment. Dipsticks urinalysis is beneficial because it is cheap, rapid and straightforward. [2]

Renal and genitourinary diseases in children contribute significantly to morbidity [3] because many children are often asymptomatic or present with subtle non-specific symptoms.[4] Urinalysis performed in these children can be used to diagnose a urinary tract infection or to rule out renal diseases [5,6]which may progress into adulthood before its manifestation. [3] Therefore, UA screening of school children will allow early detection of such diseases and prevent complications. [7] Other benefits of routine urinalysis in school-aged children include the provision of a baseline renal function to which subsequent results may be compared with later in life, information on the glycaemic control of the children, detection of those with possible diabetes mellitus and malnutrition. Previously reported pattern of urinary abnormality among school children include proteinuria, bilirubinuria, nitrituria, urobilinuria, ketonuria, haematuria [2, 7-10] and glycosuria. [11]

In Nigeria, urinalysis is not a routine screening test among school children except for few schools requesting it as part of school entry medical fitness tests. [8] Many school-aged children, especially those in public schools, are rarely screened before admission at the primary school level. This may have resulted in a missed opportunity for early diagnosis of urinary conditions with subsequent development of complications that usually characterize the presentation of many young adults in the environment. Therefore, incorporating routine medical screening, including urinalysis, to the school health programme would have a long term benefit on the children and community at large. This study aimed to describe the urinalysis pattern of pupils in primary schools in Ikenne LGA of Ogun State using urinary dipsticks, determine the prevalence of asymptomatic proteinuria among them and relate these patterns to their nutritional status and type of school.

Methods

This was a cross-sectional study, carried out in Ikenne Local Government Area (LGA) of Ogun State, Nigeria, as a part of a more extensive study. The authors had earlier described the details of study location, study design, sample size calculation, sampling technique, ethical considerations, means of entering the community, clinical examinations and anthropometric measurements. [12] Included in the study were ten public and five private primary schools within the LGA.

Inclusion criteria
   a. All pupils in the primary schools in the LGA whose parents consented to the study in writing.
   b. The absence of any chronic disease as revealed in past medical history and drug history in the questionnaire.

Exclusion criteria
   a. Pupils with fever and jaundice.
   b. Pupils with haematuria or dark urine on visual inspection.
   c. Menstruating female pupils.
   d. Pupils whose parents withheld consent.

Data Collection
The research assistants involved in this study had three sessions of training on the modes of collection of urine sample, anthropometric measurements and administration of the questionnaire. Efforts were made during the training to resolve ambiguities in the questionnaire and differences in anthropometric

measurements were reduced to barest minimum through practical sessions for the research assistants. Each of the research assistants had a minimum qualification of Ordinary National Diploma (OND) and spoke the local dialect. The same set of research assistants were used in all the schools.

An interviewer-administered questionnaire was used for data collection. It had semi-closed ended questions divided into three sections: the socio-demographic parameters, nutritional history and past medical history. The pupils had their anthropometric examinations done by one of the researchers (RATI) as described by Runsewe-Abiodun *et al*. [13] The Body Mass Index (BMI) was classified using the appropriate WHO simplified tables (WHO 2007). [14] The nutritional status was determined based on clinical parameters (pallor, angular stomatitis, Bitot spots and smooth tongue) and anthropometry, particularly the BMI.

For pupils aged less than 5 years, clean-catch urine specimens were collected into universal bottles with the support of the research assistants just before mid-day break time. The classroom teachers assisted older pupils with the collection of clean catch urine specimens. Urinalysis was carried out immediately after collection by the researchers (OO and AA). Urinalysis was done using a urine dipstick of 10 panels (DUS 10) manufactured by DFI Company Ltd, South Korea (Manufactured 2015). The dipstick was dipped into the freshly collected urine sample for 1 second and the results read within 60 seconds (leukocytes 90-120 seconds) by matching the colour changes on the dipsticks with the colour codes provided on the dipsticks container. Control for the qualitative assay was run with each dipstick as supplied and specified by the manufacturer. The dipsticks container was stored in a cool, dry place, and the sticks were prevented from exposure all through the period of specimen collection. Appropriate universal precautions were taken.

Quality Assurance
Positive and negative controls were included in every batch of urinalysis for qualitative assay. The following urine parameters were taken as normal: pH of 4.5-8.0and Specific Gravity of 1.002-1.030.

Statistical Analysis
Frequency tables were generated for both continuous and categorical variables. Means and standard deviations were compared using the Student's t-test and ANOVA. Chi-Square test with Yate's Correction and Fisher's Exact Test were used to compare proportions. The data were analyzed using SPSS software version 20. The level of statistical significance (p) was set at < 0.05.

Results

The study involved a total of 387 pupils with the age range of 36 - 192 months. The mean age was 108.24 ± 35.39 months. There were 186 males and 201 females giving a male-to-female ratio of 1:1.1. Table I depicts the demographic characteristics of the study population. A majority (67.7%) of the pupils were in the age group 60-132 months; 24.3% were older than 132 months, while 8% were aged 59 months old or less.

There was an almost equal representation of the pupils in the junior and senior classes (39.0% and 39.3% respectively) with less than a quarter (21.7%) of them in the Nursery Classes. The proportion of underweight pupils (46.8%) was almost similar to those with normal nutritional status (46.5%) while 6.7% had over-nutrition (a combination of overweight and obesity). Smooth tongue was the most common clinical sign of micronutrient deficiencies observed in the children.

In Table I, dipsticks urinalysis showed that

glucose and ascorbic acid were generally absent in the urine of all the pupils. The urine pH (4.5-8) and specific gravity (1.010-1.030) were normal in 98.2% and 99.2% of the pupils, respectively. However, urinary protein, leukocyte esterase, nitrite, bilirubin, urobilinogen, blood and ketones were detected among 18.1%, 15.8%, 14.2%, 3.3%, 2.1%, 0.8%, and 0.5% children respectively.

Table II depicts the relationship between the BMI and the urinalysis pattern of the pupils. The BMI of the pupils was not significantly related to their urinalysis pattern except for bilirubin and urobilinogen (p = 0.015 and p = 0.37 respectively). Overall, 70/387 (18.1%) pupils had dipsticks positive for protein. A higher proportion of those who were underweight (38/181; 21.0%) was dipstick positive for protein as compared with 16.7% (30/180) among the pupils with normal weight and 7.7% (2/26) among pupils with over-nutrition. While 13.8% (25/181), 15.0% (27/180) and 11.5% (3/26) of the pupils with positive dipsticks for nitrite were among the underweight, normal and over-nourished pupils respectively, 13.8% (25/181), 18.5% (33/180) and 11.5% (3/26) were positive for leukocytes among the same categories.

Table III shows that age did not significantly affect the urinalysis pattern of pupils. Although nitrites and leukocyte esterase were more commonly detected in the urine of children less than 5 years (21.2%), blood, bilirubin, ketones, were either not found at all or less prevalent among them. However, proteins and urobilinogen were more frequently found among older children (18.5% and 2.7% respectively).

With regards to gender, leukocyte esterase and nitrite were significantly more common among females (p = 0.014) as shown in Table IV.

Table V shows that there was no statistically significant difference in the urinalysis pattern among pupils in private as compared with public schools in this study. However, more positive dipsticks were recorded in pupils in public schools for bilirubin (3.6% vs 2.5%), ketones (0.7% vs 0.0%), proteins (24.4% vs 14.1%) and urobilinogen (2.6% vs 0.0%). The pupils in private schools had more positive dipsticks for nitrites (17.3% vs 13.4%) and leukocyte esterase (18.5% vs 15.0%). Out of the 70 pupils who were dipstick positive for protein 59 (84.3%) had trace proteinuria (less than 150mg/L), 5 (7.1%) had proteinuria greater than 300mg/L which was suggestive of macro-proteinuria while 6 (8.6%) had proteinuria in the nephrotic range (> 3g/L) (Table VI).

Discussion

The use of dipstick for urinalysis in this group of school pupils yielded varying abnormalities, the most frequent being proteinuria, followed by leukocyte esterase and nitrites. Similar to the studies from India [15] and Iran, [7] proteinuria was the most common urinary abnormality in this study. However, this is at variance with reports from Qatar [11] and Saudi Arabia [10], which reported haematuria and nitrituria as the most common urinary abnormalities, respectively. This may be due to a different aetiology as related to differences in geographic locations. Females have been reported to be more prone to urine abnormalities. [7, 11,16] This is similar to the finding in the present study as proteinuria was found in 18% of the pupils and had a female preponderance irrespective of nutritional status.

Table I: Pattern of dipstick urinalysis findings

Parameters		Frequency	Percentage
Glucose	Positive	0	0.0
	Negative	387	100.0
Ascorbic acid	Positive	0	0.0
	Negative	387	100.0
Blood	Positive	1	0.3
	±	2	0.5
	Negative	384	99.2
Bilirubin	1 (17)+	2	0.5
	Heavy	11	2.8
	Negative	314	96.6
Ketones	Negative	381	98.4
	Positive	2	0.5
	Indeterminate	4	1.0
Leukocyte Esterase	15+	49	12.7
	125++	2	0.5
	Negative	326	84.2
	Positive	7	1.8
	Heavy	1	0.3
	70+	2	0.5
Nitrite	Negative	332	85.8
	Positive	55	14.2
pH	<6.5	134	34.7
	6.5	115	29.7
	7	89	23.0
	7.5	31	8.0
	>7.5	18	4.6
Protein	15(0.15)± Trace	59	15.2
	30(0.3)+ 30mg/dl	5	1.3
	100(1.0)++(100mg/dl)	0	0.0
	300(30)+++(300mg/dl)	6	1.6
	200(20)++++(2g/dl)	0	0.0
	Negative	317	81.9
Urobilinogen	0.2 (3.5)	302	78.0
	1 (1.7)	8	2.1
	Negative	77	19.9

Only traces of proteinuria were found in this study; hence, it is unlikely that factors like fever, exercise and orthostasis were responsible for this observation as the pupils with fever or those recovering from febrile illness were excluded from the study and the urine samples were obtained immediately before the break time. Orthostatic proteinuria accounts for 20-60% of all asymptomatic proteinuria and mainly affects obese children. [17] However, proteinuria was less common among the over-nourished children as compared with the others in the present study. The high proportion of nitrituria and leucocyturia may be responsible for the trace proteinuria observed. The causes of false positive proteinuria like mucus, vaginal contamination of urine in females, pus, blood, urine pH> 8 and concentrated urine [18] are unlikely in the pupils, considering the nature of sampling (clean catch urine collected before break time), low haematuria and alkaluria in this study. However, since trace proteinuria is

usually transient, of no clinical relevance and have a good prognosis, [19] there may be a need

for follow up since most of the causes were excluded.

Table II: Relationship between BMI and urinalysis findings

Parameters	Nutritional status			Statistics (χ^2, p)
	Normal (n = 180)	Over-nutrition (n = 26)	Underweight (n = 181)	
Blood				
Positive	0 (0.0)	0 (0.0)	3 (1.7)	NC
Negative	180 (100.0)	26 (100.00)	178 (98.3)	
Bilirubin				
Positive	10 (5.6)	1 (3.8)	2 (1.1)	5.482, 0.064
Negative	170 (94.4)	25 (96.2)	179 (98.9)	
Ketones				
Positive	0 (0.0)	0 (0.0)	2 (1.1)	2.288, 0.319
Negative	180 (100.0)	26 (100.0)	179 (98.9)	
Leukocytes				
Positive	33 (18.5)	3 (11.5)	25 (13.8)	14.016, 0.081
Negative	147 (81.7)	23 (88.5)	156 (86.2)	
Nitrites				
Positive	27 (15.0)	3 (11.5)	25(13.8)	0.267, 0.874
Negative	153 (85.0)	23 (88.5)	156 (86.2)	
pH				
Alkaline	3 (2.2)	0 (0.0)	3 (1.7)	NC
Acidic	0 (0.0)	0 (0.0)	0 (0.0)	
Normal	77 (97.8)	26 (100.0)	178 (98.3)	
Protein				
Positive	30 (16.7)	2 (7.7)	38 (21.0)	3.173, 0.204
Negative	150 (83.3)	24 (92.3)	143 (79.0)	
Urobilinogen				
Positive	7 (3.9)	0 (0.0)	1 (0.6)	NC
Negative	173 (96.2)	26 (100.0)	180 (99.5)	
Specific gravity				
Abnormal	0 (0.0)	0 (0.0)	3 (1.7)	NC
Normal	180 (100.0)	26 (100.0)	178 (98.3)	

Figures in parentheses are percentages of the total in the respective columns.   NC – Not Computed because of empty cells

The present study also observed that few of the pupils (2.8%) were positive for significant proteinuria (>300mg/day) suggestive of macro-proteinuria and a few in the nephrotic range (urine protein >3g/day), [20] although they were asymptomatic. This is in agreement with earlier reports of asymptomatic proteinuria as an isolated finding among 0.6-6.3% of children. [21,22] This observation is suggestive of pathological causes which may be glomerular, tubular or overflow proteinuria. Based on this finding, such pupils would benefit from further estimation of proteinuria in a timed urine sample. [23] Follow-up care of these children will help with early diagnosis and management, thus preventing complications such as chronic glomerulonephritis (CGN) and chronic kidney disease (CKD). Persistent proteinuria is implicated in the progression of kidney disease, and when appropriate care is delayed, end-stage renal disease (ESRD) occurs. Untreated or poorly managed cases of pathological proteinuria lead to the progression of renal disease which persists till adulthood and patients may present at this stage with ESRD. It is interesting to note that some of the apparently healthy pupils had asymptomatic nephrotic range proteinuria suggesting the importance of screening of school children even when they are assumed healthy. However, there is a need for further evaluation of these children for appropriate management.

Table III: Relationship between age and urinalysis findings in the study population

Parameters	Age groups (months)			Statistics (χ^2, p)
	$\leq$59 (n = 33)	60-132 (n = 262)	>132 (n = 92)	
Blood				
Positive	0 (0.0)	2 (0.8)	1 (1.1)	NC
Negative	33 (100.0)	260 (99.2)	91 (98.9)	
Bilirubin				
Positive	1 (3.0)	10 (3.8)	2 (2.2)	5.482, 0.06
Negative	32 (97.0)	252 (96.2)	90 (97.8)	
Ketones				
Positive	0 (0.0)	6 (2.3)	0 (0.0)	NC
Negative	33 (100.0)	256 (97.7)	92 (100.0)	
Leukocyte esterase				
Positive	7 (21.2)	42 (16.0)	12 (13.1)	1.264, 0.53
Negative	26 (78.8)	220 (84.0)	80 (87.0)	
Nitrites				
Positive	7 (21.2)	39 (14.9)	9 (9.8)	2.9, 0.23
Negative	26 (78.8)	223 (85.1)	83 (90.2)	
pH				
4.5-8	33 (100.0)	256 (97.7)	91 (98.9)	NC
>8	0 (0.0)	6 (2.3)	93 (1.1)	
Protein				
Positive	5 (15.1)	48 (18.3)	17 (18.5)	0.211, 0.89
Negative	28 (84.4)	214 (8.7)	75 (81.5)	
Urobilinogen				
Positive	0 (0.0)	7 (2.7)	1 (1.1)	NC
Negative	33 (100.0)	255 (97.3)	91 (98.9)	
Specific gravity				
Abnormal	33 (100.0)	2 (0.8)	1 (1.1)	NC
Normal	0 (0.0)	260 (99.2)	91 (98.9)	

Figures in parentheses are percentages of the total in the respective columns. *NC – Not Computed because of empty cells

This study found that 15.8% and 14.2% of pupils had urinary leukocyte esterase and nitrite, respectively, indicative of urinary tract infections (UTI). The presence of gram positive and negative bacteria in the urine reduces nitrates to nitrites giving a positive dipstick which signifies the presence of bacteria in a concentration of 10^4 per mL. [1] Previous studies have shown that a combination of urinary nitrite and leukocyte esterase improved the sensitivity of dipsticks urinalysis in the diagnosis of UTI by up to 93%. [17, 23-25] Based on these, it may be suggested that UTI was present in the pupils as shown by the positive nitrite and leukocyte esterase (L.E.) in their urine samples. Although urine microscopy, culture and sensitivity (MCS) to confirm UTI was not done in this study, the observed nitrituria and leucocyturia indicative of UTI with female preponderance may support an earlier report that females have a higher risk of UTI than males. [26] This study, found that normal-weight pupils had a higher proportion of nitrituria and leucocyturia, compared to pupils who were underweight and over-nourished. This is contrary to an earlier report that UTI is more prevalent among malnourished children [3] suggesting that factors other than nutrition could be responsible. Such factors may include poor sanitary conditions from poor sewage disposal, inadequate water supply for personal use and poor personal hygiene. Lack or inadequate health education in schools and at homes on the benefits of personal hygiene such as cleanliness, bathing and adequate clean-up after defecating expose pupils to potential sources of infection. [27] These findings suggest that screening of children for UTI using dipsticks would allow early diagnosis and reduce the burden of delayed or untreated infection.

Bilirubinuria is another urinary abnormality observed in the pupils more commonly among normal weight pupils than the underweight and overweight pupils. Although these pupils were not obviously icteric because jaundice does not

become clinically apparent until plasma bilirubin concentration reaches 50micromole per litre (umol/L), this finding may be suggestive of conjugated hyperbilirubinaemia. Similarly, urobilinuria, which is a product of enterohepatic circulation, confirms hyperbilirubinaemia.

Table IV: Relationship between gender and urinalysis findings in the study population

Parameters	Gender		Statistics (χ^2, p)
	Male (n = 186)	Female (n = 201)	
Blood			
Positive	0 (0.0)	3 (1.5)	Fisher's p = 0.249
Negative	186 (100.0)	198 (98.5)	
Bilirubin			
Positive	7 (3.7)	6 (3.0)	0.188, 0.663
Negative	179 (96.2)	195 (97.0)	
Ketones			
Positive	3 (0.5)	3 (0.5)	0.428, 0.513
Negative	183 (99.5)	198 (99.5)	
Leukocyte esterase			
Positive	17 (9.1)	43 (21.5)	11.071, 0.0008
Negative	168 (90.8)	157 (78.5)	
Nitrite			
Positive	19 (9.7)	36 (18.0)	5.451, 0.019
Negative	167 (90.3)	165 (82.0)	
pH			
Abnormal	5 (2.7)	2 (1.0)	0.764, 0.381
Normal	181 (97.3)	199 (99.0)	
Protein			
Positive	28 (15.1)	42 (21.0)	2.222, 0.136
Negative	158 (84.9)	159 (79.0)	
Urobilinogen			
Positive	5 (2.7)	3 (1.5)	0.22, 0.639
Negative	181 (97.3)	198 (98.5)	
Specific gravity			
Abnormal	2 (1.1)	1 (0.5)	0.005, 0.942
Normal	184 (98.9)	200 (99.5)	

Figures in parentheses are percentages of the total in the respective columns.

The presence of bilirubinuria and urobilinuria had a slight male preponderance. This is similar to the previous report that bilirubinuria and urobilinuria were more common among boys accounting for 1.7% and 1.8% of urine abnormality respectively in children from northern Nigeria. [8] On the contrary, bilirubinuria accounted for 0.2% while no urobilinuria was reported from an earlier study conducted in Ile-Ife, Nigeria. [28] Common causes of hyperbilirubinaemia include haemolysis from membrane defects, enzymopathies, haemoglobinopathies, ABO incompatibility, transfusion reactions, severe malaria and infections. However, since the pupils were apparently healthy children without chronic diseases and the normal weight pupils had more proportion of bilirubinuria and urobilinuria, the possibility of ABO incompatibility, transfusion reactions, sickle cell disease or severe malaria were not likely. Establishing the causes of these findings would require further evaluation.

The normal urine pH of 4.5 to 8.0 is a reflection of the plasma pH of an individual. This suggests that many of the pupils in this study had a normal plasma pH. Few pupils had alkaline urine, which probably supports the observed nitrituria and leucocyturia. It has been reported that alkaline urine in the presence of nitrituria and leucocyturia may suggest the presence of urea-splitting organisms with or without associated ammonium magnesium phosphate crystals. [27]

Table V: Comparison of dipstick urinalysis findings of pupils in private and public schools

Parameters	Types of schools		Statistics (χ^2, p)
	Private (n = 80)	Public (n = 307)	
Blood			
Positive	1 (1.2)	2 (0.7)	0.033, 0.855
Negative	80 (98.8)	304 (99.3)	
Bilirubin			
Positive	2 (2.5)	11 (3.6)	0.023, 0.878
Negative	79 (97.5)	295 (96.4)	
Ketones			
Positive	0 (0.0)	2 (0.7)	0.53, 1.0
Negative	81 (100.0)	304 (99.3)	
Leukocyte Esterase			
Positive	15 (18.5)	46 (15.0)	0.586, 0.443
Negative	66 (82.5)	260 (85.0)	
Nitrite			
Positive	14 (17.3)	41 (13.4)	0.793, 0.373
Negative	67 (82.7)	265 (86.6)	
pH			
Abnormal	1 (1.2)	6 (2.0)	0.001, 0.973
Normal	80 (98.8)	300 (98.0)	
Protein			
Positive	10 (14.1)	60 (24.4)	2.279, 0.131
Negative	71 (85.9)	246 (75.6)	
Urobilinogen			
Positive	0 (0.0)	8 (2.6)	Fisher's p = 0.213
Negative	81 (100.0)	298 (97.4)	
Specific gravity			
Abnormal	0 (0.0)	3 (1.0)	Fisher's p = 1.0
Normal	81 (100.0)	303 (99.0)	

Figures in parentheses are percentages of the total in the respective columns.

Table VI: Grading of proteinuria according to gender among pupils in private and public schools

Level of proteinuria	Public Schools		Private Schools		Total
	Male	Female	Male	Female	
≥15mg/dL	24 (88.9)	27 (81.8)	1 (100.0)	7 (77.8)	59 (84.3)
≥30mg/dL	1 (3.7)	3 (9.1)	0 (0.0)	1 (11.1)	5 (7.1)
≥1g/dL	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
≥3g/dL	2 (7.4)	3 (6.1)	0 (0.0)	1 (11.1)	6 (8.6)
Total	27 (100.0)	33 (100.0)	1 (100.0)	9 (100.0)	70 (100.0)

Figures in parentheses are percentages of the total in the respective columns

Dipstick was positive for haematuria in 0.8% of the pupils in the present series, similar to previous reports. [4, 8, 29-32] This finding may suggest glomerular, renal and urologic damage for which microscopy is required to rule out interfering substances such as myoglobin giving false positive results. [6]

The clinical benefits of dipstick urinalysis include the ability to detect ketones, which usually are absent in urine. However, 0.5% of the pupils (underweight) had ketonuria. This aligns with an earlier report of 0.6% prevalence of ketonuria observed in urine examination of school children in Jos, Nigeria. [8] The presence of ketonuria could be due to uncontrolled diabetes mellitus (DM), pregnancy, reduced carbohydrate meals and starvation. However, diabetes mellitus is extremely unlikely because of the absence of glycosuria in all the subjects.

Since ketonuria was only present in the underweight pupils, it could be inferred that they were extremely undernourished to being starved or are in a fasted state. An earlier report from the same study population reported that two of the pupils had no meals at all the day prior to the interview and almost half of them had one meal the day prior. [13] Ketones are products of fatty acid metabolism serving as an alternative source of energy in periods of hypoglycaemia or fasting states.

Glucose was the only other parameter that was absent in the urine of all the pupils. This finding is similar to studies in Nigeria [8] and India [9] suggesting good glycaemic control, preserved renal threshold for glucose and low prevalence of diabetes mellitus among children. The previously reported prevalence of diabetes mellitus in children was 0.4% [33], and the prevalence of renal glycosuria was 0.05%. [34] However, it is possible that the fasted state to the starvation of the children was responsible for this observation.

The inability to do follow-up care for the pupils with abnormal dipsticks urinalysis is acknowledged as a limitation to this study.

Conclusion

This study has demonstrated that urinary abnormalities are common among children, with proteinuria as the most common finding followed by nitrituria, leucocyturia, bilirubinuria, urobilirubinuria, haematuria and ketonuria. Dipsticks being cheap, requiring minimal training for health workers and not dependent on electricity can be deployed as valuable tools for initial assessment of genitourinary diseases and screening of children before school enrolment, especially in resource-poor settings.

Therefore, this study recommends incorporating routine medical screening (including urinalysis using dipsticks) to health programmes for primary schools as this would have a long term benefit on the children and community at large.

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