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Urine examination findings in apparently healthy new school entrants in Jos, Nigeria

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Background. Urinalysis as a part of medical examination of fitness in schoolchildren is useful in detecting abnormalities that could identify early disease conditions.

Objective. To describe the urine examination findings in apparently healthy newly enrolled primary school entrants in Jos, Plateau.

Methods. Through a multistage stratified randomisation procedure, 650 apparently healthy pupils were selected to have a complete physical examination in the morning with mid-stream urine samples collection. The urine samples were examined for abnormalities using dipsticks.

Results. There were 301 boys and 349 girls (ratio 0.9:1). Their mean age was 6.6±1.3 years (range 5 - 12 years). Urinary abnormalities were present in 63 (9.6%) of the subjects, with most in the 6 - 8-year age group. Proteinuria was the most common abnormality, detected in 23 (3.5%), and next, urobilinogen in 12 (1.8%) subjects. The latter was significantly greater in male and private school subjects (p=0.03). Haematuria and nitrituria were present in 10 (1.5%) subjects, while 11 (1.7%) had bilirubinuria. Four (0.6%) subjects had ketones in their urine but none had glycosuria. Two pupils (0.2%) had both haematuria and proteinuria but no associated elevated blood pressure.

Conclusion. Urine abnormalities are not uncommon in new school entrants; this study underscores the importance of urine examination in children at the point of school entry.

Urine testing is an essential component of medical examination, and the basic dipstick method is the most common screening procedure for the early detection of renal or urinary tract diseases in apparently healthy or asymptomatic subjects.[1,2] Renal diseases are increasingly common causes of childhood morbidity and mortality.[3] Some of these diseases, if undetected and not treated early, may lead to debilitating chronic disease.

Proteinuria is an early manifestation of renal disease. Similarly haematuria, though not as common as proteinuria, may be indicative of renal or urinary tract disease. Studies have shown that positive urine tests for haematuria and/or proteinuria in mass screening settings were significant predictors of end-stage renal disease.[4] The presence of detectable nitrite in urine has been used to diagnose urinary tract infection.[5,6] Urinary tract infections are common in childhood, and may be sub-clinical or present with nonspecific symptoms and signs, and have the potential for long-term complications.[4]

At the point of school entry, a valid screening test should help to identify early disease conditions in schoolchildren, which may affect learning, normal school activities and later quality of life. Such screening should form part of the services provided in school health services and would be useful in the prevention of, and early intervention in, disease.[7] Ideally, every child should undergo routine medical examination three times while at school – at school entry, midway through school and on completion of schooling.[8] This is particularly relevant in a developing country such as Nigeria, where many school-age children are survivors in an environment of very high under-5 mortality rates resulting from nutritional deficiencies and infections.[9]

Relatively few studies have addressed urinary findings in healthy children at the point of school entry. Most studies in Nigeria have been solely on proteinuria and/or haematuria and bacteriuria.[10-12] The study by Abdurrahman[11] described a prevalence rate of urinary abnormalities as 3.8%, but this study assessed only one primary school in Kaduna, Northern Nigeria, over 25 years ago. Primary schoolchildren form a sizeable fraction (around 23%) of the population of an average Nigerian community.[13] On school entry, mass screening of schoolchildren's urine will be helpful in detecting abnormalities that may suggest early signs of urinary tract infections, kidney disease and diseases of other organs that result in metabolites that appear in urine.

This study was therefore carried out to assess urine findings in apparently healthy primary school beginners in the Jos North local government area (LGA) to ascertain the magnitude of the problem in this locality.

Study design and methods

Ours was a descriptive cross-sectional study of apparently healthy primary school beginners between 5 and 12 years old in Jos North, Plateau State, Nigeria. The study was carried out

between October 2002 and May 2003. Approval to conduct the study was obtained from the ethical committee of the Jos University Teaching Hospital, 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.

A sample size of 650, which was calculated using a standard formula,[14] was required to establish the set objectives. For the years 2002/2003, 8 380 and 3 872 children were newly enrolled into public and private schools respectively. Using proportionate random sampling, 445 pupils from public and 205 pupils from private schools were selected. The pupils were given a complete physical examination. Weight and height were measured, followed by a general examination for pallor, fever, facial and leg swelling, and skin lesions. Each pupil's abdomen and cardiovascular and respiratory systems were examined. Those with abnormal findings were excluded from the study. Mid-stream urine was collected from the pupils into wide-necked clean bottles after explanation by the investigator and class teacher. Genital cleaning was not done before the sample was collected. The appearance and colour of the urine were noted, and it was immediately tested using the Medi-Test Combi 9 multistick (Macherey-Nagel, Duren, Germany) for proteinuria, haematuria, nitrituria, glycosuria, ketonuria, bilirubinuria and urobilinogenuria. The urine findings were recorded, and proteinuria and haematuria of 1+ or more were considered significant.

Pupils with persistently abnormal findings on review 2 and 4 weeks later were referred to the Paediatric Outpatient Department of Jos University Teaching Hospital for further investigations and management. Follow-up data were not included in the analysis of this study.

Statistical analysis

EPI Info 2000 version 1.1.2a statistical software was used for data analysis. Urine multistick test results were expressed as means ± standard deviation (SD). Student's *t*-test was used to compare means of variables, while the chi-square test was used for significance of association. A *p*-value <0.05 was considered significant.

Results

Six hundred and fifty primary one (first-year) pupils, comprising 301 boys and 349 girls (ratio 0.9:1), were randomly selected for the study. Their mean age was 6.7±1.38 v. 6.6±1.24 years, respectively. There were 205 subjects from private schools, and 445 from public schools. Socio-economic assessment showed that 93% of pupils in the public schools were of low socio-economic status while 95% from private schools were of high and middle socio-economic status.

Sixty-three (9.6%) pupils had urinary abnormalities of varying frequencies, and some subjects had more than one abnormality detected. Proteinuria had the highest prevalence (3.5%), while ketones were the least detected abnormality, occurring in only 4 (0.6%) subjects, with no associated glycosuria detected. The other abnormalities detected are shown in Fig. 1.

Most urine abnormalities were found in children from public schools except for that of urobilinogen, which had a higher prevalence in private schools (Fig. 2). When stratified by sex, abnormal urine findings were more common among females than males; however, these differences were not statistically significant (p>0.05).

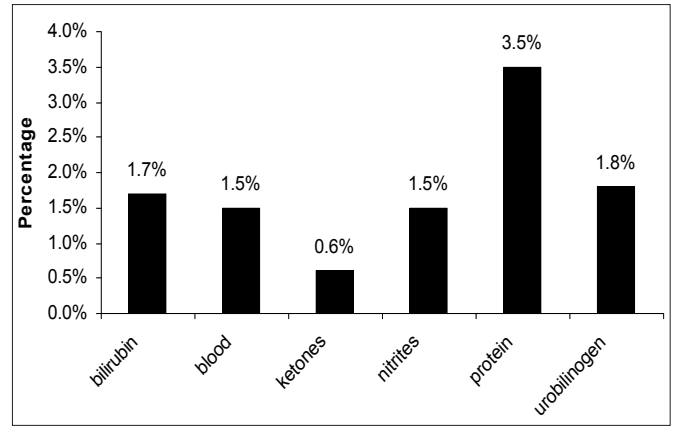

Fig. 1. Prevalence of urine findings among new school entrants.

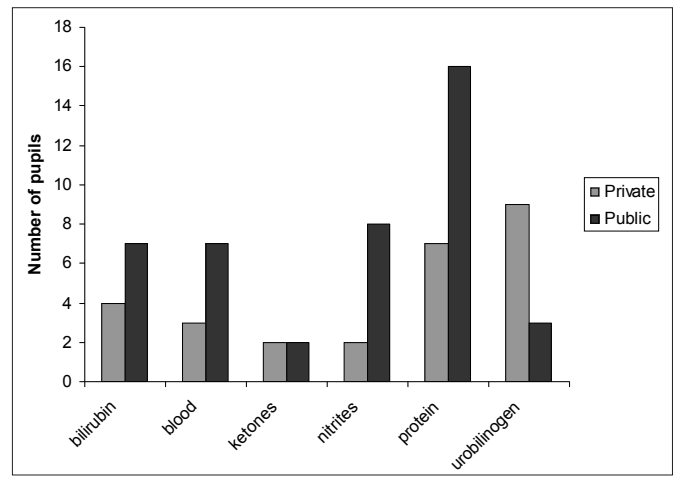

Fig. 2. Frequency of urine findings by type of school.

The proportion of children with malnutrition in the study population, using the 5th percentile weight for age, was 17.8% as opposed to a higher proportion of 22% among those with urinary abnormalities.

Discussion

Our study highlights some salient features in the urine examination of apparently healthy schoolchildren. The finding of urinary abnormalities in nearly 10% of the study group is significant and should settle the age-old debate as to whether routine urinalysis in apparently healthy children is warranted, in the affirmative. It also reinforces the point made by Arant on the necessity of screening for urine abnormalities.[16]

The percentage of urine abnormality in this study is higher than the prevalences of 3.8% and 6% cited by Abdurrahman *et al.*[11] and Dodge *et al.*[15] respectively. In the latter case, this may be attributable to the fact that more urine abnormalities than only proteinuria and haematuria were tested for.

Proteinuria was the most common abnormality in this study, with a prevalence of 3.5%, which is similar to the 3.8% reported in a study of 600 schoolchildren,[11] and higher than the 1% reported by Ikimalo *et al.*[17] The higher prevalence in our study could also partly be due to the contribution of orthostatic proteinuria from the use of random midstream urine samples. The occurrence of proteinuria in such a high proportion of children may suggest the influence of the presence of other endemic conditions peculiar to the local environment.

For example, in the series by Onifade and Grange[10] where the prevalence of proteinuria was 7.5%, they ascribed this to schistosomiasis. Schistosomiasis is prevalent in the study environment.[18] The endemicity of malaria and quartan malaria infection, which causes immune complex nephritis, may also contribute to the prevalence of proteinuria.[19] However, the latter is usually associated with nephrotic syndrome, and only two female subjects had proteinuria in the nephrotic range.

Proteinuria occurred more commonly in girls than boys although this was not statistically significant and was similar to one study[11] but contrasted with another[10] that had more males with proteinuria. This finding might have resulted from contamination from the female genital tract.

The 1.5% prevalence of haematuria in our study is lower than the 3.8%, 2.6% and 3.9% from previous studies.[11,20,21] The higher prevalence in the latter was ascribed by the authors to schistosomiasis.[21] Schistosomiasis is a known local environmental problem in the population where this work was carried out, with an even higher prevalence of 39% among secondary school students.[18]

The finding of haematuria and proteinuria in two girls in this study is instructive as it may suggest the presence of underlying renal disease in these subjects. Renal diseases such as nephritis are common in developing countries, where survey screening has shown a high prevalence for proteinuria with or without haematuria.[7,13] The simultaneous occurrence of these two abnormalities has been shown to be a significant predictor of end-stage renal disease.[4,22]

Although this study did not set out to assess urinary tract infections, the presence of nitrites was found in 1.5% of subjects, which is indicative of urinary tract infections although the subjects were asymptomatic. The finding of a higher frequency of nitrituria among females could be a reflection of higher rates of bacteriuria in the females of the study group, since the nitrites are generated in the urine by bacteria.[23] Studies among school-age children have shown that bacteriuria among girls is 30 times the prevalence among boys, attributed to the fact that girls have a short urethra which predisposes them to ascending bacterial infection.[24]

The presence of bilirubinuria, which is a reflection of conjugated hyperbilirubinaemia, tends to suggest increased haemolysis or obstruction. The most common causes of haemolysis in the local environment include malaria, sickle cell disease and infections. The study subjects were apparently healthy children who had no clinical evidence of liver dysfunction or hepatomegaly. Malaria parasitaemia has been proposed as the intercurrent cause of covert haemolysis in seemingly healthy children. The high prevalence of 1.8% of urobilinogenuria was similar to the 1.7% of bilirubinuria. Elegbe *et al.* in their study did not find any urobilinogen in the urine, while bilirubinuria occurred in 0.2%.[21] The higher prevalence in this study cannot be readily explained since bilirubin is normally not detected in urine while there may be a trace of urobilinogen in the urine.[1] However, environmental factors may play a role. Urobilinogenuria is also an indicator of increased haemolysis or conjugated hyperbilirubinaemia. That this finding was commoner in boys may be a pointer to a haemolytic cause. Given that glucose-6-phosphate dehydrogenase (G6PD) deficiency could be a common cause of haemolysis, particularly in the face of infection or malaria parasitaemia, it is possible that a proportion of boys who might have been G6PD-deficient suffered from haemolysis secondary to malaria. This is speculative since none of the boys had jaundice.

Routine urinalysis should be part of medical examination of pupils at the point of school entry.

Ketonuria in our study was infrequent (0.6%) and was even less common in the Elegbe *et al.* study (0.08%).[21] The presence of ketones in the absence of glycosuria might have resulted from some form of caloric deprivation (starvation) or an overnight fast.

Subjects with urinary abnormalities had poorer nutritional status, compared with the general study population (22.2% v. 17.8% respectively), which could be because most of those with abnormalities were from public schools and had poorer socio-economic backgrounds. Private schools were fee-paying schools while public schools were government non-fee-paying schools, mostly attended by pupils from the low socio-economic class who are the least nourished and most likely to acquire disease.[25,26]

Although our study did not set out to find the causes of these urine abnormalities, their presence in such magnitude could be indicative of asymptomatic disease. A repeat urinalysis at a later date and hospital referral for those with persistent abnormalities is advocated in such instances to afford affected children further investigations and appropriate management.

Conclusion

Urine abnormalities are not an uncommon finding in new school entrants, with proteinuria being the most prevalent abnormality. Routine urinalysis should be part of medical examination of pupils at the point of school entry and further follow-up offered to determine those with underlying renal disease.

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