Prevalence of Hematuria among School Children in Makkah and Baha in Saudi Arabia

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Abstract

Objective: Screening of kidney diseases by urinalysis in school children has been approved in many parts of the world with inexpensive tools such as urinary dipsticks. In this study, we investigated the prevalence of hematuria in a large sample of 6 to 15-year-old school students in Makkah and Baha, Saudi Arabia.

Design: A total population of 12,347 students in primary and middle schools in Makkah and Baha, Saudi Arabia, were investigated for hematuria during 2007. There were 7,299 students in Makkah (5,007 boys and 2,292 girls) and the remaining 5,048 were in Baha (2,734 boys and 2,314 girls), aged from 6 to 15 years old. All the studied children were apparently healthy and asymptomatic. Parents' consents were taken prior to the test. A random fresh mid-stream urine was collected to complete the urine analysis (by dipstick and microscopy) to detect microscopic hematuria, albuminuria or pus cells. Measurements of the height and weight were also done and blood pressure was measured for each student.

Results: Among the 12,347 students screened and urine samples provided, 2,745 (22.23%) had hematuria, 1,822 (14.76% of the total population) from Makkah and 923 (7.48%) from Baha. Analysis of the prevalence of hematuria in students in Makkah and Baha showed that there was a very highly significant difference between the two cities (P value = 0.0000). There were 842 students (7% of the total population) had positive hematuria and hypertension and 2,678 students (22%) had negative hematuria and hypertension with a highly statistically significant difference between positive hematuria students and negative students in the prevalence of hypertension (P value = 0.0044).

Conclusion: Asymptomatic hematuria might be detected by the school screening program and should be considered as an inexpensive way for early management of some renal diseases.

Keywords: Hematuria, dipstick, urinalysis, albuminuria.

Introduction

Screening of kidney diseases has been of interest to many investigators for the last three decades. For example, Japan [1] and the USA [2] used urinalysis for screening in children and adolescents primarily with the commonly used dip and read test strips (dipsticks), mainly to detect hematuria. Several studies have demonstrated that urinalysis is the simplest and least expensive method for screening healthy children. Mass screening has been performed in Japan for the early diagnosis of chronic renal diseases since 1973.[1,3,4]

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Hematuria is usually seen in the primary period of systemic diseases and kidney diseases, such as acute glomerulonephritis and urinary tract infections (UTI).[5] Early detection of these findings and diagnosis of the disease may facilitate preventing, halting and deferring the progression of some diseases. The aim of the current study was to screen the prevalence of hematuria and urine abnormalities among 12,347 school students in Makkah and Baha, Saudi Arabia.

Study Objectives

To assess the prevalence of hematuria in school students aged from 6 to 15 years old in Makkah and Baha, Saudi Arabia.

Methodology

It was a cohort study where 12,347 school students were randomly recruited from 44 schools in Makkah which is located 73 km inland from Jeddah in a new narrow valley at a height of 277 m above the sea level and randomly 40 schools in Baha which is located in southwest Saudi Arabia. The sample consisted of 7,299 students (59.1%) from Makkah (5,007 boys and 2,292 girls) while the remaining 5,048 students (40.8%) were from Baha (2,734 boys and 2,314 girls), aged from 6 to 15 years old.

All students were given a questionnaire to be filled out by their parents, regarding the child's age, gender, and health conditions. Measurements taken for each student were body weight, height, and blood pressure. Measurements were taken by trained volunteers in a consistent, standardized manner. Body weight was measured to the nearest tenth of a kilogram on a calibrated digital scale, with the child's shoes removed. Height was measured with the child standing with shoes removed, measured in centimeters to the nearest millimeter. Blood pressure was measured twice, once manually and once digitally, using an appropriate cuff size, based on arm circumference, and the mean was taken and used for analysis. Blood pressure was categorized according to BP tables from the Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents, using age and height percentiles, with normotension defined as a BP under the 90th percentile, pre- hypertension 90th to 95th percentile, and hypertension greater than 95th percentile or an absolute systolic BP (SBP) of $\geq$ 120mmHg or diastolic BP (DBP) of $\geq$ 80mmHg. Children were also classified as hypertensive if they were taking antihypertensive medication or had been diagnosed with hypertension previously.

Urine specimens were obtained from each student, tested with urine dipsticks for hematuria, proteinuria and glucosuria. If positive results were confirmed, a microscope was used to examine a urine sample. Students were from 6-15 years, both sexes were represented, and all were asymptomatic and healthy at inclusion while children who had any of the following disorders were excluded: non-orthostatic proteinuria, previous urolithiasis, documented urinary tract infection (UTI), acute or chronic glomerulopathies, sickle cell disease, known bleeding diathesis and chronic systemic illness.

Statistical Methodology

Frequency tables (number, percent) were mainly calculated for all the measurements. Comparability tests were measured among students of the two cities of the study using chi-square test for categorical variables, like sex, etc. and t-test for continuous variables, like age levels. Significance was detected at p value < 0.05

Patients' Demographics

The cohort study included 12,347 school students, of which 7,299 (59.12% of the total population) from Makkah while the remaining 5,048 (40.88%) were from Baha, with a mean age of 9.23 $\pm$ 0.02 years (6 to 15 years), mean weight of 30.92 $\pm$ 0.10 Kgs (11 to 97 Kgs), and mean height of 131.03 $\pm$ 0.10 cm (93 to 170 cm). The average systolic blood pressure was 113.68 $\pm$ 0.13 mmHg (60 to 199 mmHg) and the average of diastolic blood pressure was 72.09 $\pm$ 0.09 mmHg (29 to 100 mmHg).

Table (1): The sample characteristics.

Distribution		Overall	Makkah Boys	Girls	Baha Boys	Girls	P Value Makkah Vs Baha
	Total	12,347	5,007 (40.55%) 7,299 (59%)	2,292 (18.56%)	2,734 (22.14%) 5,048 (41%)	2,314 (18.74%)	0.0000
Age	Mean $\pm$ SE	9.23 $\pm$ 0.02 years	8.87 $\pm$ 0.03 years	9.76 $\pm$ 0.04 years	9.69 $\pm$ 0.04 years	8.92 $\pm$ 0.04 years	0.0000
	Range	6 – 15 years	6 – 15 years	6 – 14 years	6 – 13 years	6 – 13 years	
Weight	Mean $\pm$ SE	30.92 $\pm$ 0.10 Kg	30.89 $\pm$ 0.16 Kg	32.44 $\pm$ 0.25 Kg	30.36 $\pm$ 0.19 Kg	30.15 $\pm$ 0.20 Kg	0.0000
	Range	11 – 97 Kg	11 – 97 Kg	12.6 – 90 Kg	13 – 68.5 Kg	15 – 81 Kg	
Height	Mean $\pm$ SE	131.03 $\pm$ 0.10 Cm	129.57 $\pm$ 0.15 Cm	133.43 $\pm$ 0.24 Cm	133.55 $\pm$ 0.2 Cm	128.84 $\pm$ 0.21 Cm	0.8908
	Range	93 – 170 Cm	101 – 170 Cm	93 – 164 Cm	106 – 170 Cm	108 – 160 Cm	
Systolic Blood Pressure	Mean $\pm$ SE	113.68 $\pm$ 0.13 mmHg	115.72 $\pm$ 0.19 mmHg	120.76 $\pm$ 0.31 mmHg	109.63 $\pm$ 0.15 mmHg	107.03 $\pm$ 0.33 mmHg	0.0000
	Range	60 – 199 mmHg	91 – 188 mmHg	80 – 191 mmHg	60 – 161 mmHg	60 – 199 mmHg	
Diastolic Blood Pressure	Mean $\pm$ SE	72.09 $\pm$ 0.09 mmHg	71.41 $\pm$ 0.16 mmHg	77.11 $\pm$ 0.21 mmHg	71.34 $\pm$ 0.12 mmHg	69.47 $\pm$ 0.22 mmHg	0.0000
	Range	29 – 100 mmHg	29 – 100 mmHg	47 – 99 mmHg	50 – 95 mmHg	40 – 95 mmHg	

Results

Urine analysis

A very highly significant difference was detected between Makkah students and Baha students in the prevalence of hematuria (P value = 0.000), 1,300 students (10.53% of the total population) had hematuria in Makkah student boys, 522 (4.23%) in Makkah student girls while 670 (5.43%) in Baha student boys and 253 (2.04%) in Baha student girls.
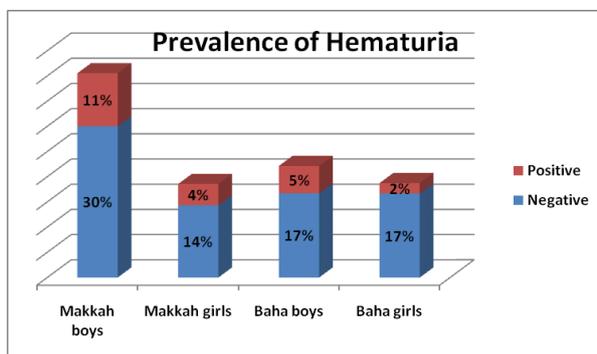

Figure (1): The prevalence of hematuria between students in Makkah and Baha.

There was a highly statistically significant difference between positive hematuria students and negative students in the prevalence of hypertension (P value = 0.0044), where 842 positive hematuria students (7% of the total population) had hypertension and 2,678 negative hematuria students (22%) had hypertension.
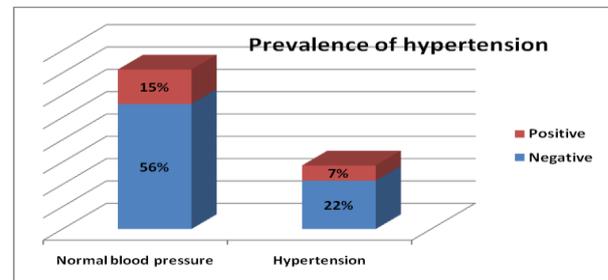

Figure (2): The prevalence of hypertension between students in Makkah and Baha.

Also, there was a very high statistically significant difference between Makkah students and Baha students in the prevalence of proteinuria (P value = 0.0000), where 4,285 student boys (34.70% of the total population) and 1,065 student girls (8.63%) had proteinuria in Makkah, while 81 student boys (0.66%) and 37 girls (0.3% of the total population) had proteinuria in Baha.
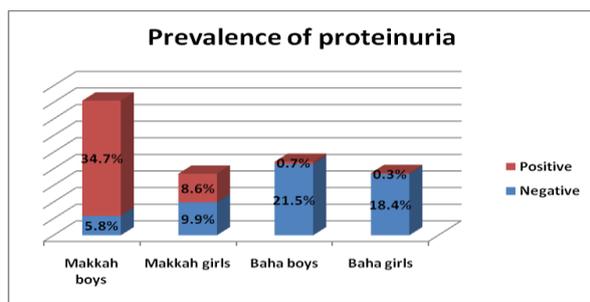
Figure (3): The prevalence of proteinuria between students in Makkah and Baha.
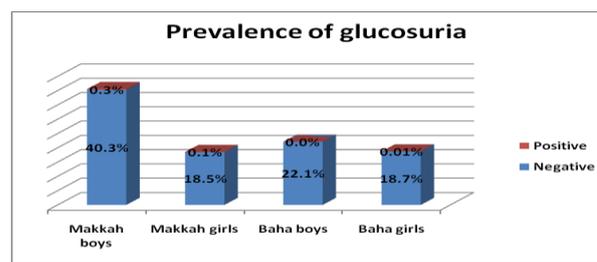

Figure (4): The prevalence of glucosuria between students in Makkah and Baha.

In regards to glucosuria, there was a very highly significant difference between Makkah and Baha students in prevalence (P value = 0.0000), as 36 student boys (0.29% of the total population) and 13 student girls (0.11%) had glucosuria in Makkah, while only one student had glucosuria in Baha.

There was a very highly statistical difference between Makkah students and Baha students in specific gravity, PH measurements, leucocyte, nitrite, ketone and bilirubin (P value = 0.000); data also showed the highly statistical difference in urobilinogen measurements (P value = 0.005) among the study groups.

Table (2): The detailed urine analysis.

		Overall	Makkah Boys	Girls	Baha Boys	Girls	P Value
Specific Gravity	Mean ± SE	1.02 ± 0.00	1.02 ± 0.00	1.02 ± 0.00	1.02 ± 0.00	1.02 ± 0.00	0.000
	Range	0.025 – 1.25	0.025 – 1.25	1 – 1.03	1 – 1.25	1 – 1.03	
PH	Mean ± SE	5.45 ± 0.01	5.42 ± 0.01	5.42 ± 0.01	5.45 ± 0.02	5.54 ± 0.02	0.000
	Range	5 - 10	5 – 9	5 - 9	5 - 10	5 – 9	
Leucocyte	Negative	11373 (92%)	4533 (91%)	1869 (82%)	2722 (99.6%,	2249 (97%)	0.000
	Positive	974 (8%)	474 (9%)	423 (18%)	12 (0.4%)	65 (3%)	
Nitrite	Negative	11978 (97%)	4738 (95%)	2247 (98%)	2715 (99%)	2278 (98%)	0.000
	Positive	369 (3%)	269 (5%)	45 (2%)	19 (1%)	36 (2%)	
Ketone	Negative	11944 (97%)	4693 (94%)	2227 (97%)	2710 (99%)	2314 (100%)	0.000
	Positive	403 (3%)	314 (6%)	65 (3%)	24 (1%)	0 (0%)	
Urobilinogen	Negative	12254 (99%)	4944 (99%)	2287 (99,8%)	2734 (100%)	2289 (99%)	0.005
	Positive	93 (1%)	63 (1%)	5 (0.2%)	0 (0%)	25 (1%)	
Bilirubin	Negative	11456 (93%)	4340 (87%)	2209 (96%)	2635 (96%)	2272 (98%)	0.000
	Positive	891 (7%)	667 (13%)	83 (4%)	99 (4%)	42 (2%)	

Discussion

Our study was designed to find out the differences in the prevalence of hematuria between Makkah and Baha school students. Hematuria was measured in this study with a urine dipstick and microscopy. Hematuria was defined as the presence of 5 or more red blood cells (RBCs) per high-power field.

The survey revealed that 1,822 Makkah students (14.75% of the total population) had hematuria versus 923 Baha students (7.47% of the total

population) with very highly statistically significant difference between them with P value= 0.000. We will discuss the predisposing factors and the relation of renal stones with the prevalence of hematuria in the new study.

Murakami M et al found that the annual incidence of urinary abnormality in elementary school children from 6 to 10 years old was 0.19% for hematuria.[1] Another study showed that the cumulative occurrence of hematuria was high, greater than 6%.[9] The study done by Vehaskari et al screened an unselected population for

hematuria; four urine specimens from each were examined and microscopic hematuria was found in one or more specimens in 4.1%, and in two or more specimens in 1.1% of the studied children.[10] Dodge et al conducted urinalyses on 6 to 12 year old children and found hematuria in 0.34% of females and 0.12% of males.[11]

The study of Park identified a total of 1,044 school children with hematuria and/or proteinuria during a mass school urine screening test and they were referred to pediatric nephrologists at 13 hospitals in Korea. These children had isolated hematuria (IH) (60.1%), isolated proteinuria (IP) or combined hematuria and proteinuria (CHP) (13.5%). This study showed that the use of a mass school urine screening program can detect chronic renal disease in its early stage.[7]

Although Kaplan and colleagues stated that multiple screening dipstick urinalyses in asymptomatic pediatric patients are costly and should be discontinued, they proposed a single screening dipstick urinalysis to be obtained at school entry age, between 5 and 6 years, in all asymptomatic children.[5]

Kawasaki et al found that early identification by yearly school urinary screening may enable early management and improve prognosis for renal diseases in children.[8]

Although our study had a higher prevalence rate, unlike the above mentioned statistics, we can use these detected abnormalities to indicate its impact. Screening tests, such as blood pressure, growth and development, and general physical examination are being conducted in all preschool children. If dipstick urinalysis with its inexpensive costs could be added to our country's screening program, it could contribute to the detection of the affected children in their early stages of renal diseases, resulting in the survival of kidneys at risk.

Conclusion

The prevalence of hematuria in school students in Makkah and Baha showed findings rather higher than other related studies. It was also found that it

would be possible to screen a large population of children at a relatively low cost, providing the framework for further actions that may lead to the prevention and timely diagnosis of renal diseases.

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انتشار البيلة الدموية في عينة من طلاب المدارس في مكة المكرمة والباحة في المملكة العربية السعودية

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الملخص

الهدف: هدفت هذه الدراسة إلى الكشف عن أمراض الكلى بين أطفال المدارس في أنحاء كثيرة من العالم عن طريق أدوات غير مكلفة كتحليل البول مثلا. وفي هذه الدراسة قمنا بالتحقيق في انتشار البيلة الدموية في عينة كبيرة من 6 إلى 15 سنة من طلاب المدارس في مكة المكرمة والباحة في المملكة العربية السعودية.

التصميم: قد تم تطبيق البيلة الدموية في هذه الدراسة على 12347 طالبا وطالبة في المدارس الابتدائية والإعدادية في مكة المكرمة والباحة، في المملكة العربية السعودية، خلال عام 2007. 7299 طالبا وطالبة منهم من مكة المكرمة (5007 ذكور و2292 إناث) و5048 طالبا وطالبة من الباحة (2734 ذكور و2314 إناث)، تتراوح أعمارهم بين 6 سنوات و15 سنة. كان جميع أطفال الدراسة أصحّاء. وقد أخذت الموافقات من الآباء قبل إجراء الاختبار وجمعت عينة البول عشوائيا في منتصف تيار البول لاستكمال تحليل البول حسب المقياس المجهري للكشف عن البيلة الدموية مجهريا، البيلة القيحية أو الخلايا. وتم إجراء قياسات الطول والوزن وقياس ضغط الدم لكل طالب وطالبة.

النتائج: فحصت عينات البول بين 12347 طالباً وطالبة، حيث تبين أن 2745 (22.23 ٪) مصابون بالبيلة الدموية، 1822 بنسبة (14.76 ٪) منهم من مكة المكرمة و923 بنسبة (7.48 ٪) من الباحة. وقد أظهر تحليل انتشار البيلة الدموية أن هناك فرقاً كبيراً جداً بين المدينتين: مكة المكرمة والباحة (0.0000 = P قيمة).

الخلاصة: قد يتم الكشف عن البيلة الدموية التي بدون أعراض عن طريق برنامج الفحص من قبل المدارس، حيث تعد وسيلة غير مكلفة للكشف المبكر عن بعض الأمراض الكلوية.

الكلمات الدالة: البيلة الدموية، مقياس، تحليل البول، بيلة.