

## Prevalence Rate of Urinary Tract Infection and Disorder of Urinary Profiles in the 7-12 Years Old Healthy Children in Tabriz, Iran

Babak Abdinia<sup>1,\*</sup>, Masumeh Mohkam<sup>2</sup>, Abdollah Karimi<sup>2</sup>, Farzaneh Alikhah<sup>3</sup>

<sup>1</sup> Pediatric Health Research Center, Tabriz University of Medical Sciences, Tabriz, IR Iran

<sup>2</sup> Pediatric Infections Research Center, Shahid Beheshti University of Medical Sciences, Tehran, IR Iran

<sup>3</sup> Departments of Pediatric Infectious Diseases, Tabriz University of Medical Sciences, Tabriz, IR Iran

\*Corresponding author: Babak Abdinia, Pediatric Health Research Center, Departments of Infectious Diseases, Tabriz University of Medical sciences, Tabriz, IR Iran. Tel: +98-4115262280, Fax: +98-4113357143, E-mail: babdinia@yahoo.com.

### ABSTRACT

**Background:** Early detection of renal diseases in children can be beneficial for prevention, delaying disease progression, reduction of the number of patients with progressive renal failure. The most common metabolic disorders predisposing renal calculus in children are: hypercalciuria, hyperuricosuria, hyperoxaluria, renal tubular acidosis, and hypocitraturia.

**Objectives:** In this research, we studied the prevalence of urinary infection in healthy elementary school children in Tabriz city and analyzed their urinary profiles.

**Patients and Methods:** This cross-sectional descriptive research was performed in the year 2011, on 312 students who were selected from the students of Tabriz city schools using random cluster sampling. A second morning urine sample was collected in order to analyse the urine and the random levels of calcium, creatinine, uric acid, oxalate, citrate and protein; and the kidneys and urinary tract ultrasonographies were performed.

**Results:** In this research 312 students were studied. Prevalence rate of urinary infection was 3.8 %, 6.3% of girls and 0.7% of boys were positive. The performed ultrasonographies indicated; 0.3% hydronephrosis, 0.3% renal calculus, 0.6% duplication and 5.4% thickened bladder. 1.6% of children had Proteinuria. There were 4 cases, 1.28%, of girls' and 1 case, 0.32%, among boys' who had hematuria. A total of 8.01% (n = 25) hypercalciuria, 7.05% of oxaluria (n = 22), 1.28% of hyperuricosuria (n = 4) and 13.46% of hypocitraturia (n = 42) were observed among the subjects.

**Conclusions:** The results of this research; showed the effectiveness of urinary screening in schools; indicated that early detection of renal diseases in children can be beneficial for prevention, delaying disease progression, reduction of progressive renal failure. These results might be due to geographic differences, diet and genetic background.

**Keywords:** Kidney Diseases; Child; Hypercalciuria

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►Implication for health policy/practice/research/medical education:

This study will help to formulate policy regarding urinary screening of school children.

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## 1. Background

Generally, renal diseases have no obvious symptoms and signs, and might lead to renal failure. Early detection of renal diseases in children is beneficial for prevention, delaying the disease progression, reduction of the number of patients with progressive renal failure and reduction of mortality and morbidity rate (1). In some countries there are long-term urinary screening programs for early detection of renal diseases, and various researches has shown the effectiveness of these programs (2). Prevalence of urinary tract infection among school aged children, is about 7% for girls and 1% for boys (3). Of course different prevalence rates are reported in different studies. Prevalence of renal calculus in the US is 1/1000 – 1/7600 of hospitalizations and its annual incidence is 109 in 100000 for men and 36 in 100000 for women (4). Prevalence of hypertension and hypercalciuria, and prevalence of hematuria in children are associated with various genetic and environmental factors and regional statistics are listed for particular areas (5). However, considering the age and other relevant factors, this prevalence will have significant variations in different communities (6). Considering the increasing prevalence of renal calculus and other renal problems and their complications, it seems that by knowing its accurate rate, we could have a significant role in reducing its complications as well as increasing knowledge about the predisposing causes of these diseases (7). We often notice the presence of hematuria while examining urinary infection or in a routine urine test. Prevalence of hematuria from school screenings in China was 5% and a study performed on adolescents in the US showed that the prevalence of Hematuria and Proteinuria was 4.6% and 0.8%, respectively (8). Several studies were performed in order to determine the prevalence of asymptomatic hematuria in different countries; and they all mentioned that by urine screening for hematuria and proteinuria using urine tests and urinalysis, underlying renal diseases such as various forms of glomerulopathy and anatomical disorders, and existence of renal calculus can be discovered. It seems that hypercalciuria has a significant prevalence. According to Tukey's statistics, prevalence of hypercalciuria in children was 9.6% (9). A study in Canada has reported that hypercalciuria can be a predisposing factor for future renal calculus and hypertension; and therefore its study, and timely diagnosis and treatment is very important (6).

## 2. Objectives

In this research, we studied the prevalence of urinary infection in healthy elementary school children in Tabriz

city and analyzed their urinary profiles.

## 3. Patients and Methods

In this study, in the year 2011, [educational] centers were selected by the cross-sectional method based on random tables, and again from those centers a certain number of 7-12 years old children were selected based on random tables and finally, 312 children were studied. Routine examinations were performed on the selected children and their demographic information including age, weight, height and blood pressure were recorded in the information forms. A second morning urine sample was collected from each child in order to analyze the urine and random levels of calcium, creatinine, phosphorus, magnesium, sodium, potassium, uric acid, oxalate, citrate, cysteine and protein. Ultrasonographies of kidneys and urinary tract were performed on all of the selected children by a radiologist and an ultrasonographic specific device (Ultrasonix.canada.3/7&5MHZ). In the above study, the normal values for urinary tests were determined as follows: the ratio of calcium to random creatinine less than 0.2, the ratio of uric acid to random creatinine less than 1, the ratio of oxalate to random creatinine less than 0.08, the ratio of citrate to random creatinine more than 1 and less than 40 meq of sodium in one liter. UTI (urinary tract infectious) defined pyuria and was clinically significant if there was  $> 10^5$  organisms/mL in the urine. The patients information were inserted into the provided information forms, and were analyzed by the SPSS statistical tests.

## 4. Results

312 elementary school students in the age group of 7 to 12 years were studied, 55.1% of these students were female ( $n = 172$ ) and 44.9% were male ( $n = 140$ ). The demographic information of these patients is summarized in *Table 1*. The total rate of urinary infection prevalence, based on positive urine cultures of above 105 per milliliter were 3.8% ( $n = 12$ ). 6.3% ( $n = 11$ ) of girls and 0.7% ( $n = 1$ ) of boys were positive, and there was a significant correlation between the two groups. 0.6% of children ( $n = 2$ ) had proteinuria. In the performed ultrasonographies, there were a total number of 21 abnormal cases, including: 0.3% ( $n = 1$ ) hydronephrosis, 0.3% ( $n = 1$ ) renal calculus, 0.6% ( $n = 2$ ) duplication and 5.4% ( $n = 17$ ) thickened bladder were reported; with no significant relation between female and male. 1.6% of children had hematuria ( $n = 5$ ). In the analysis of urinary profiles of children, there were a total number of 8.01% ( $n = 25$ ) hypercalciuria, 7.05% of oxaluria ( $n = 22$ ), 1.28% of hyperuricosuria ( $n = 4$ ) and 13.46% of hypocitraturia ( $n = 42$ ) in children.

**Table 1.** Demographic Data and Urine Analysis

	Minimum	Maximum	Mean $\pm$ SD
Age, y	7	12	0.08 $\pm$ 9.45
Weight, kg	11	66	0.48. $\pm$ 28.58
Height, cm	126	162	0.71 $\pm$ 132.63
Urine Creatinine, (mg/dL)	0.2	200	2.12 $\pm$ 65.993
Calcium (mg/dL)	0.39	17	0.21 $\pm$ 5.466
Mg (mg/dl)	0.1	30	0.70 $\pm$ 14.21
Phosphorus (mg/dL)	2	138	1.59 $\pm$ 48.32
Sodium (mEq/L)	7	290	4.38 $\pm$ 131.5
Potassium (mEq/L)	2	120	1.55 $\pm$ 46.85
UrinepH	5	9	0.27 $\pm$ 5.28
Urine Oxalate	0.3	5.4	0.05 $\pm$ 2.47
Urine Uric Acid	2	172	1.07 $\pm$ 24.4
Urine Citrate	0.11	120	1.19 $\pm$ 16.17
Gravity	1002	1033	0.41 $\pm$ 10.18.62
Systolic blood pressure (mmHg)	80	125	0.64 $\pm$ 101.69
Diastolic blood pressure (mmHg)	50	80	0.4 $\pm$ 65.71

## 5. Discussion

In this research, the prevalence rate of urinary infection was 3.8%. 6.3% of girls and 0.7% of boys had positive cultures. In a study, performed on 44816 school children in Malaysia, the prevalence of urinary infection was 0.54%, with greater numbers among girls (10). In another study on 7 year old girls and boys in Sudan, 7.8% of girls and 1.6% of boys had urinary infections (11). In this study, kidney anatomic disorders were 6.7%, where 5.4% of them were related to a thickened bladder. Hypercalciuria, oxaluria, hyperuricosuria, hypocitraturia and cystinuria are some of the metabolic causes, predisposing urolithiasis (12). In a recent research from the US, it was reported that in the last 10 years, incidence of urolithiasis has shown about a 5 fold increase (13). In 75% of children with renal calculus, the predisposing causes are detectable. In Ratan's research from Delhi, which was performed in 2002, it was suggested that the most common cause of renal calculus is the lack of urinary citrate and Hypercalciuria (14). Also, Stitchantrakul, in 2007, suggested that the most common cause of renal calculus in Thai children was low urinary citrate level, hypercalciuria and low urine volume. In terms of the prevalence of underlying disorders, in this research, hypocitraturia was the most common and followed by hypercalciuria, hyperoxaluria and hyperuricosuria, respectively (15). In our study the prevalence of hypercalciuria was 8.01%, yet it needs more research in order to determine its causes. Low number of samples was one of the limitations of our work; nevertheless, prevalence of hypercalciuria, oxaluria, hyperuricosuria and hypocitraturia was high

among the children in the studied area. It must be noted that no extensive study has been performed in our country to determine the normal amounts of urinary excretion of calcium, uric acid and oxalate, and this fact in addition to using values mentioned in other countries researches as criteria, justifies the differences in the results. In our study, 1.6% of children had hematuria and there was no significant relationship between males and females. During 1998 in Korea about 5 million students were screened, where 0.8% had hematuria. Also, biopsies were performed, for 63% of the above mentioned group with isolated hematuria and 69.9% of those with joint proteinuria and hematuria; IgA nephropathy was determined as the most common cause (16). In the annual urinary screening of Japan, abnormal urinary results were found in 0.52% of elementary school children and 0.75% of older children (17). The prevalence of glomerulonephritis especially nephropathy IgA among Japanese and other Asian races is high and the urine test is the best method for early detection of glomerulonephritis (18). Discovering proteinuria by the strip test is one of the cheap and available methods for prevention of progressive renal failure. Considering the results of the current research and the 0.6% prevalence of proteinuria, we suggest performing screenings for school children. The results of this research indicated the effectiveness of urinary screening in schools, which is beneficial for prevention, delaying the disease progression, reducing the number of patients with progressive renal failure and reducing the mortality and morbidity rate, by early detection of renal diseases.

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## Authors' Contributions

None declared.

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