

## Research Article

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# Prevalence of Nephrolithiasis in 7-11 year-old Students: A Multicenter Study

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**Introduction:** Renal diseases can be asymptomatic even in progressive disorders; therefore, detecting urine and ultrasound abnormalities may help facilitate early diagnosis and prevention of renal diseases. This study was conducted to investigate random urine parameters and urinary system ultrasonography findings in 7-11 year-old students.

**Materials and Methods:** Healthy students from Tehran and Qom, Iran were enrolled in a prospective descriptive study and their sex, age, weight, height, and BMI were measured. Then, a fresh clean urine sample was collected and ultrasonography of the urinary tract was done. The urine specimen was tested for urine Ca/Cr, urine oxalate/Cr, and urine citrate/Cr.

**Results:** Of 932 students, 47.9% were female and 52.1% were male. The age range of the students was 7-11 years with a mean age of 9.08 years. A history of renal disease and UTI was positive in 1.1% and 9.9% of the students, respectively. Ultrasound was normal in 78% and abnormal in 22% of the students. Abnormal findings included hydronephrosis in 1.1%, fullness of the urinary tract in 0.1%, urinary system duplication in 3%, urolithiasis in 0.7%, decreased kidney size in 0.4%, increased bladder thickness in 8.9%, and other abnormal findings in 7.8% of the subjects. Abnormal urine findings included hypercalciuria in 10.9%, urine hyperuricosuria in 5.4%, urine hyperoxaluria in 12.8%, and hypocitraturia in 96.9% of the students.

**Conclusions:** According to the results, nephrolithiasis may be due to hyperoxaluria, hypercalciuria, and hyperuricosuria in a normal population. Genetics and nutrition are more important risk factors. Therefore, some nutritional interventions for decreasing urine oxalate, calcium, and uric acid may be beneficial.

**Keywords:** Urinalysis; Ultrasonography; Hypercalciuria; Hyperuricosuria; Hyperoxaluria; Child.

**Running Title:** Prevalence of Nephrolithiasis in 7-11 year-old Students

## Introduction

About 90% of urinary stones contain calcium as a major constituent, and 60% are composed of calcium oxalate. Most "spontaneous" stones are composed of calcium, oxalate, or phosphate crystals.

Between 30% and 60% of children with calcium stones have hypercalciuria without hypercalcemia. Other metabolic aberrations that predispose to stone disease include hyperoxaluria, hyperuricosuria, hypocitraturia, heterozygous

cystinuria, hypomagnesuria, hyperparathyroidism, and renal tubular acidosis [1].

In one study, 3014 students from Yazd, Iran were screened and urinary abnormalities were detected in 94 (3.1%) subjects. The rate of proteinuria was 1.79% as the most common urine abnormality. Hematuria was present in 16 subjects. Fifteen cases had positive results for blood, 12 for ketones, and 21 for nitrite in the urine [2]. In a case-control study, 202 children aged 1 month to 15 years with urinary stones and 302 children without nephrolithiasis were compared according to the calcium/creatinine ratio. In the case group, the calcium to creatinine ratio was significantly higher compared to the control group [3].

In a cross-sectional study in Qom, 110 primary school children (56 girls and 54 boys) aged 7 to 11 years were investigated. Only one child had renal stone (1%), but the prevalence of abnormal renal ultrasonography was 7%. Hypercalciuria and hypocitraturia was detected in 23% and 100% of the students, respectively [4].

In a study of 312 students aged 7-12 years old in Tabriz, proteinuria, hypercalciuria, hyperoxaluria, hyperuricosuria, and hypocitraturia was in 1.6%, 8.1%, 7.05%, 1.28%, and 13.46% of the students, respectively [5].

In this study, we investigated random urine parameters and urinary system ultrasonography findings in 7-11 year-old students.

## Materials and Methods

Healthy students from Tehran and Qom, Iran were enrolled in a prospective descriptive study. Informed consent was obtained from the students' parents, and their sex, age, weight, height, and BMI were measured. Then, a fresh clean urine sample was collected to measure Cr, Na, K, Mg/Cr, Ca/Cr, protein/Cr, Oxalate/Cr, uric acid/Cr, citrate/Cr, and Cysteine/Cr. Ultrasound examination of the urinary tract was done in some students according to the consent. This research was approved by ethic committee of Pediatric Infections Research Center of Shahid Beheshti University of Medical Sciences.

## Results

Of 932 students, 47.9% were female and 52.1% were male. The age range of the students was 7-11 years with a mean age of  $9.08 \pm 1.28$  years. The weight, height and BMI range were  $30.49 \pm 9.95$ ,  $132.71 \pm 10.77$  and  $16.95 \pm 3.47$  respectively. About 1.1% of the students had a history of known

renal disease and in 9.9% positive history of UTI was detected.

Abnormal urine findings included abnormal levels of urine Na in 93.3%, urine K in 79.2%, urine Mg/Cr in 56.7%, urine Ca/Cr in 10.9%, urine Oxalate/Cr in 12.8%, urine protein/Cr in 1.2%, urine uric acid/Cr in 5.4%, and urine citrate/Cr in 96.9% of the subjects (table 1). All students showed normal levels of urinary cysteine. The prevalence of crystalluria was 4.4% in our study, which included triple phosphate in 0.6%, calcium oxalate in 1%, and amorphous crystals in 2.8% of the students.

Ultrasonography was normal in 78% and abnormal in 22% of the participants. Abnormal findings included hydronephrosis in 1.1%, fullness of the urinary tract in 0.1%, urinary system duplication in 3%, urolithiasis in 0.7%, decreased kidney size in 0.4%, increased bladder thickness in 8.9%, and other abnormal findings in 7.8% of the subjects.

## Discussion

Urinary stones are mostly composed of calcium oxalate. Most "spontaneous" stones are composed of calcium, oxalate, or phosphate crystals. Between 30% and 60% of children with calcium stones have hypercalciuria. Other metabolic risk factors include hyperoxaluria, hyperuricosuria, hypocitraturia, heterozygous cystinuria, hypomagnesuria, hyperparathyroidism, and renal tubular acidosis. A study of the metabolic risk factors of urolithiasis in 248 Turkish children showed hypercalciuria, hypocitraturia, hyperoxaluria, hyperuricosuria, and cystinuria in 41%, 39%, 22%, 9%, and 4% of the patients, respectively [6]. Moreover, some drugs like ceftriaxone are associated with nephrolithiasis [7]. In a study in Turkey, 324 healthy children were divided into four age groups as < 7 months, 8-18 months, 19 months to 6 years, and 7-14 years. A random urine specimen from each subject was analyzed for calcium and creatinine. The median urine calcium/Cr was 0.10 in the age group 7-14 years [8]. Sorkhi H performed a study in 590 healthy children aged 7-11 years in the north of Iran. In this study, early morning random urine samples taken from all children were analyzed for calcium and creatinine. The mean urinary Ca/Cr ratio was  $0.155 \pm 0.095$  [9]. The mean urinary calcium/creatinine ratio was 0.2 ( $\pm 0.17$ ) and the prevalence of hypercalciuria was 37.8% in another study of 362 children aged 7-12 years in Kashan, Iran [10].

**Table 1.** Mean and standard deviation of Urinary solute and electrolytes in study group

Parameters	Mean $\pm$ standard deviation	Abnormal %	Minimum	Maximum
U Cr (mg/dL)	68.67 $\pm$ 35.98	-	2.80	200
U Na(meq/dL)	133.66 $\pm$ 57.8	93.3	7	290
U K(meq/dL)	48 $\pm$ 20.75	79.2	2	120
U Ca/Cr	0.29 $\pm$ 2.79	10.9	0	45.50
U Protein/Cr	0.07 $\pm$ 0.04	1.2	0.02	0.25
U Oxalate/Cr	0.07 $\pm$ 0.40	12.8	0	8
U Uric acid/Cr	0.72 $\pm$ 5.30	5.4	0.02	100
U Citrate/Cr	0.28 $\pm$ 0.41	96.9	0	6.07
U Cysteine/Cr	0	0	0	0.09
U Magnesium/Cr	0.36 $\pm$ 2.59	56.7	0	41

In Finland, proteinuria was found in one of four specimens in 10.7% and in two of four specimens in 2.5% of 8,954 children aged 8 to 15 years [11]. The prevalence of asymptomatic proteinuria was 6.2% in 2068 schoolchildren (age group 12–14 years) in Kashmir valley, which persisted in 2.17% after the second dipstick examination [12]. In our study, the rate of proteinuria was 4.1% in one dipstick sample.

Overall the mean length of the kidney is 83.3 mm at 7.5 years, 89 mm at 8.5 years of age, 92 mm at 9.5 years, 91.7 mm at 10.5 years, and 96 mm at 11.5 years and the left kidney is slightly longer (about 3 mm) than the right kidney. Our findings were consistent with the above values.

## Conclusions

According to the results, nephrolithiasis may be associated with nutrition, lack of adequate fluid intake, and decrease physical activity in a normal population. Some nutritional interventions are recommended to decrease the urinary level of oxalate.

## Conflict of Interest

Authors declare that they have no conflicts of interest.

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## References

1. Robert M, Kliegman MD, Bonita F, Joseph W. St Geme, Nina F. Schor REB. No Title. 20<sup>th</sup> edition. 2016.
2. Jafari Nodoshan AAH, Shajari A, Golzar A, Shakiba M. Urinary screening in primary school children in yazd, iran. Shiraz E Med J. 2015;16(1):1–4.
3. Safaeian B, Alaei E, Ariannejad S, Behnampoor N, Alizadeh S, Hasheminejad R, et al. The urine level of calcium to creatinine ratio in children suffering from urolithiasis. J Maz Univ Med Sci. 2013;23(108):77–81.
4. Akhavan-Sepahi M, Sharifian M, Mohkam M, Vafadar M, Hejazi S. Biochemical risk factors for stone formation in healthy school children. Acta Med Iran [Internet]. 2012;50(12):814–8. Available from: <http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L368169532%5Cnhhttp://sfx.umd.edu/hs?sid=EMBASE&issn=00446025&id=doi:&atitle=Biochemical+risk+factors+for+stone+formation+in+healthy+school+children&stitle=Acta+Med.+Iran.&title=Acta+>
5. Abdinia B, Mohkam M, Karimi A, Alikhah F.

- Prevalence rate of urinary tract infection and disorder of urinary profiles in the 7-12 years old healthy children in Tabriz, Iran. *Arch Pediatr Infect Dis.* 2013;1(3):122-5.
6. Celiksoy MH, Yilmaz A, Aydogan G, Kiyak A, Topal E, Sander S. Metabolic disorders in Turkish children with urolithiasis. *Urology.* 2015 Apr;85(4):909-13.
  7. Mohkam M, Karimi A, Gharib A, Daneshmand H, Khatami A, Ghojevand N. Ceftriaxone associated nephrolithiasis: A prospective study in 284 children. *Pediatr Nephrol.* 2007;22(5):690-4.
  8. Ceran O, Akin M, Akturk Z, Ozkozaci T. Normal urinary calcium/creatinine ratios in Turkish children. *Indian Pediatr.* 2003 Sep;40(9):884-7.
  9. Sorkhi H, Aahmadi MH. Urinary calcium to creatinin ratio in children. *Indian J Pediatr.* 2005;72(12):1055-6.
  10. Honarpisheh A, Hooman N, Taghavi A. Urinary Calcium Excretion in Healthy Children Living in. 2009;19(2):154-8.
  11. Vehaskari VM, Rapola J. Isolated proteinuria: Analysis of a school-age population. *J Pediatr* [Internet]. 1982 Nov 1;101(5):661-8. Available from: [http://dx.doi.org/10.1016/S0022-3476\(82\)80287-4](http://dx.doi.org/10.1016/S0022-3476(82)80287-4)
  12. Valley K, Method UD, Malla HA, Bhat AM, Shazia B, Rather FA, et al. of Kidney Diseases and Transplantation Renal Data from Asia – Africa Prevalence of Proteinuria in School Children ( Aged 12 – 14 Years ) in. 2016;27(5):1006-10.
  13. Avner ED, Harmon WE, Niaudet P, Yoshikawa N, Emma F, Goldstein SL. *Pediatric Nephrology.* 7<sup>th</sup> Edition, 2016.