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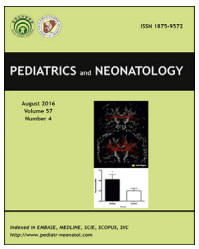

Original Article

Differential prevalence of hematuria and proteinuria with socio-demographic factors among school children in Hualien, Taiwan

Ming-Chun Chen [a], Jen-Hung Wang [b], Chia-Hsiang Chu [a], Ching-Feng Cheng [a,b,c,*]

[a] *Department of Pediatrics, Hualien Tzu Chi Hospital Buddhist Tzu Chi Medical Foundation, Hualien, Taiwan*
[b] *Department of Medical Research, Tzu Chi General Hospital, Hualien, Taiwan*
[c] *Department of Pediatrics, College of Medicine, Tzu-Chi University, Hualien, Taiwan*

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Key Words
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hematuria;
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proteinuria

Background: Pediatric hematuria/proteinuria is a risk factor for chronic kidney disease in later life, and school urinary screening can detect asymptomatic glomerulonephritis in the early stage. This study aimed to evaluate the prevalence of hematuria/proteinuria and its association with different socio-demographic factors among school children in 2013 in Hualien, Taiwan.
Methods: A cross-sectional study was conducted among first, fourth, and seventh graders. Health examination results and urinalysis data were analyzed. Logistic regression models were used to the simultaneously analyze the association between the prevalence of hematuria/proteinuria and socio-demographic factors.
Results: A total of 9544 students were included. The overall prevalence of hematuria and proteinuria was 4.1% and 5.7%, respectively. Students who were females, of a high grade level, of aboriginal ethnicity, and living in rural areas had higher hematuria risk (all $P < 0.001$) than other students. Underweight students had low odds ratio (0.53) of hematuria ($P < 0.001$). Seventh-grade students had higher odds ratio (3.63) of proteinuria than first grade students ($P < 0.001$). Students with both parents of aboriginal descent had lower odds ratio (0.81) of proteinuria than those with non-aboriginal parents ($P = 0.044$). Only higher grade level students had significantly higher risk of combined hematuria and light proteinuria (odds ratio: 10.67) and heavy proteinuria with/without hematuria (odds ratio: 3.22) than first graders.
Conclusion: Increased hematuria/proteinuria prevalence was noted in our county as compared to prior studies. Hematuria/proteinuria was significantly associated with gender, grade level,

* Corresponding author. Department of Pediatrics, Hualien Tzu Chi Hospital Buddhist Tzu Chi Medical Foundation, No. 707, Chung Yang Rd., Sec. 3, Hualien 970, Taiwan. Fax: +886 3 857 7161.
E-mail addresses: chengcf@mail.tcu.edu.tw, loveroflois1980@gmail.com (C.-F. Cheng).

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body mass index, ethnicity, and residence urbanization. Our data can be used for future longitudinal dataset collection to prevent pediatric renal disorders in Taiwan.

1. Introduction

Chronic kidney disease (CKD) is a worldwide health problem that progresses to end-stage renal disease (ESRD), and it is also a harbinger for cardiovascular diseases. The school urinary screening system can detect asymptomatic glomerulonephritis (GN) manifesting as urinary abnormalities and it has been performed in several countries such as Taiwan, Japan, and Korea, where GN is frequently the primary cause of ESRD.[1–3] The annual incidence of pediatric ESRD is 8.12 per million of age-related populations in Taiwan, and a recent study confirmed that the most common presentations at diagnosis of pediatric CKD in Taiwan were hematuria and proteinuria.[4,5] Early aggressive management for patients with combined hematuria—proteinuria and nephrotic-range proteinuria patients is helpful to delay the progression of CKD.[3] Currently, dipstick tests are widely used for initial screening as a simple and inexpensive method for detecting urinary abnormalities.

In Taiwan, Lin et al. reported that 0.3% of the screened students from 1991 to 1998 had abnormal urinalysis, and 7.4% of these students had heavy proteinuria with high risk to develop nephritis and hypertension.[1] Since 2007, all school children in Hualien have received a health examination including a urinalysis in grades 1, 4, and 7 by the same tertiary care hospital in eastern Taiwan. Our previous study reported that the overall prevalence of hematuria and proteinuria in 2010 among Hualien school children was 3.8% and 2.4%, respectively,[6] and increased prevalence of hematuria and proteinuria was found in the following years (unpublished data). Children with persistent isolated microhematuria have an increased risk for renal damage and CKD progression due to cytotoxic, oxidant, and inflammatory effects induced by heme or hemoglobin released from red blood cells.[7] Childhood hematuria/proteinuria is influenced by age, gender, and body mass index (BMI).[8,9] However, socio-demographic associations and the possible risk stratification for these school children are unclear, and little information is available regarding the data in Hualien, East Taiwan. Therefore our study is the first to evaluate the prevalence and severity of hematuria and proteinuria, as well as their association with different socio-demographic factors among school children in 2013 in Hualien, Taiwan. This study may help prevent the possible occurrence of CKD in the future.

2. Methods

2.1. Subjects

Data used in this comparative descriptive cross-sectional study were collected in the fall of 2013 from first (aged 7—8 years) and fourth (aged 10—11 years) graders of all elementary schools and seventh graders (aged 13—14 years) of all junior high schools in Hualien County, Taiwan. A total of 9544 students from 105 elementary schools and 25 junior high schools were included in our study. Informed consent was obtained from the students' parents or guardians. The consent form, offered by the Hualien County Government Education Bureau, informed parents/guardians that these examinations were non-intrusive with minimum risk, and the students were free to withdraw from any examination item at any time. The study was reviewed and approved by the Hualien County Government Education Bureau. An approval certificate for this study was also issued from our Institutional Research Ethics Committee (REC No.: IRB105-52-B).

2.2. Measurements and procedures

This study evaluated the prevalence and severity of hematuria/proteinuria, as well as their association with different socio-demographic factors among school children in Hualien. A physical examination team from Tzu Chi General Hospital, including pediatricians and nurses, was employed to perform physical examinations in each school. The children were instructed to completely empty their bladder at night, and first early-morning urine specimen was examined by the dipstick method to detect hematuria and proteinuria.[10] Positive reactions were defined as 1+ or higher for both isolated hematuria and proteinuria.[11] Equivocal data were not included in abnormal urinalysis of our statistical analysis. Abnormal urine samples with microscopic hematuria with light proteinuria (1—2+, 30—100 mg/dl) or heavy proteinuria (>2+; >100 mg/dl) with/without microscopic hematuria, indicating higher risk of prominent renal damage, were further analyzed.[1]

Underweight and overweight/obese were defined based on age- and gender-specific BMI cut-off points from Taiwanese national reference values for children and adolescents developed by the Department of Health in Taiwan.[12] Children were grouped as underweight, normal, and overweight/obese. Population density (person per square kilometer, km^2) is a major indicator for urbanization levels. Residence urbanization was categorized into three groups, namely, rural (below 15), suburban (from 15 to below 500), and urban (above 500), according to population densities of residential areas.[13] Based on this categorization, the distribution of residence urbanization level was three (23%) rural, seven (54%) suburban, and three (23%) urban.

2.3. Statistical analysis

The data were presented as frequencies, proportions, or means ± standard deviations, depending on the

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