Kidney Disease Profiles Among Adolescents In Indonesia

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ABSTRAK

Latar belakang: *setiap gangguan ginjal berisiko menjadi penyakit ginjal kronik dan gagal ginjal terminal yang berkaitan dengan peningkatan mortalitas dan beban pembiayaan. Di negara berkembang, khususnya di Indonesia, data di komunitas mengenai penyakit ginjal kronik masih sangat terbatas. Tujuan penelitian ini untuk mengetahui profil klinis dan karakteristik penyakit ginjal pada remaja berusia 15-18 tahun di Indonesia.* ***Metode:*** *penelitian ini merupakan studi potong lintang yang mengolah data Riset Kesehatan Dasar 2013 pada anak remaja berusia 15-18 tahun. Terdapat dua kelompok data berdasarkan pencatatan di lapangan. Kelompok data I meliputi data subjek yang diperoleh dengan menggunakan kuesioner, meliputi riwayat batu ginjal, gagal ginjal kronik, riwayat hipertensi, riwayat minum obat antihipertensi, serta pemeriksaan fisis berupa pengukuran tekanan darah. Kelompok data II adalah subyek pada kelompok data I yang dilengkapi dengan data laboratorium, berupa kadar hemoglobin dan kreatinin serum.* ***Hasil:*** *dari 52.454 didapatkan 20.537 (39%) remaja dengan penyakit ginjal pada kelompok data I, dengan karakteristik sebagian besar perempuan dengan status gizi baik. Terdapat riwayat batu ginjal sebanyak 0,2%, gagal ginjal kronik 0,1%, riwayat hipertensi 0,6%, riwayat minum obat antihipertensi 0,1%. Pada pemeriksaan tekanan darah ditemukan stadium pra-hipertensi dan hipertensi, masing-masing 51,4% dan 48,3%. Kelompok data II menunjukkan subjek dengan penurunan fungsi ginjal sebesar 1,4%.* ***Kesimpulan:*** *angka hipertensi dan pra-hipertensi pada remaja usia 15-18 tahun di Indonesia cukup tinggi. Pemeriksaan tekanan darah secara teratur perlu dilakukan sebagai upaya deteksi dini, untuk mencegah progresivitas penyakit.*

Kata kunci: *remaja, penyakit ginjal, hipertensi, pra-hipertensi, Riskesdas.*

ABSTRACT

Background: *every kidney injury may develop into chronic kidney disease (CKD) and end stage renal disease (ESRD) that are associated with high mortality and socio-economic burden. There is limited data about the clinical characteristics of children having CKD in developing countries, espesially in Indonesia. This study aimed to describe clinical profiles and characteristics of kidney diseases in adolescents aged 15-18 years.* ***Methods:*** *this study was a cross-sectional study using data from National Basic Health Survey (Riskesdas) 2013. There were two groups of data. The first data group consisted of questionnaires about history of kidney stone disease, hypertension, chronic renal failure, antihypertension administration, and blood pressure measurement. The second data group included subsamples of the first group which had laboratory test results, e.g. hemoglobin and serum creatinine levels. All of the data were classified based on nutritional status, estimated glomerulofiltration rate (eGFR), blood pressure classification, and hemoglobin level.* ***Results:*** *among 52,454 adolescents in the first data group, 20,537 (39%) had kidney diseases, were predominantly female and had good nutritional status. Other findings were data on history of kidney stone disease (0.2%), chronic renal failure (0.1%), history of*

hypertension (0.6%), antihypertensive agents consumption (0.1%). Prehypertension and hypertension were found in 51% and 48.3% of adolescents, respectively. Adolescents with decreased eGFR were accounted for 1.4%. ***Conclusion:*** *the proportion of prehypertension and hypertension in adolescents aged 15-18 years in Indonesia was high. Hence, routine blood pressure measurement is important for early detection and prevention of kidney disease progression.*

Keywords: *adolescent, kidney disease, hypertension, prehypertension, National Basic Health Survey.*

INTRODUCTION

Kidney damage is defined as any abnormality of kidney structure or function, which initially occuring without any change of glomerular filtration rate (GFR), leading to decreased kidney function, which may lead to the development of chronic kidney disease (CKD) and end stage renal disease (ESRD).[1] CKD has become a significant public health problem and a socio-economic burden of almost 28 million dollars every year in the United States.[2] In 2008, a study in Turkey reported an increasing prevalence of children aged 5-18 years with CKD compared to the previous study in 2005.[3] The incidence of children with CKD in Vietnam reached 5.1 cases/million/year.[4] A study in seven hospitals in Indonesia found that 2% of 2,889 inpatient children presented with kidney diseases. The cases of children with CKD increased by 4.9% in 1991 to 13.3% in 1996-2000 at Cipto Mangunkusumo Hospital, a tertiary referral hospital in Jakarta.[5]

Most children with CKD manifest asymptomatically and often are found at an advanced stage. They often complain of unspecific signs, such as: paleness, general weakness, and presenting with anemia, hypertension, or growth disorders. Other CKD patients are found accidentally after serum creatinine and or urinalysis tests.[6] The management of children with CKD especially among adolescents has its own challenges. Children with CKD may have psychological problems and require assistance, while the parents of these children may need further guidance and understanding.[7]

Since 2007, National Institute of Health Research and Development (NIHRD), Indonesia Ministry of Health has periodically conducted a nationwide community-based health research, known as Indonesia Basic Health Research (Riset Kesehatan Dasar/Riskesdas). This research was conducted every three years to evaluate the achievement of health programs that had been implemented in Indonesia. Data from Indonesia Basic Health Research can describe the situation at the national, provincial, and district levels due to their substantial sample numbers. They also provided laboratory examination data in the Indonesia Basic Health Research 2013.[8,9]

The data regarding the characteristics of kidney disease in Indonesian adolescents are still limited. Therefore, we aimed to describe the clinical profiles and characteristics of kidney disease among adolescents in Indonesia based on Basic Health Research 2013.

METHODS

The study design was a cross-sectional study using the large-scale data of National Basic Health Research (Riskesdas) year 2013 with selected subjects of adolescents aged 15-18 years. Data were collected by trained enumerators or field officers using a structured and standardized questionnaires to obtain information, physical examination and laboratory tests.[9] This study has been approved by The Ethics Committee of the Faculty of Medicine Universitas Indonesia with a reference number 532/UN2.F1/ETIK/2017.

For practical purposes, we grouped the data from National Basic Health Research into two data groups. The first data group included data collected by a questionnaire about subjects' age, gender, history of hypertension, current consumption of antihypertensive agents, history of kidney disease and kidney renal failure. This data group also included physical examination data of weight, height, and blood pressure measurement. The second data group consisted of subsamples of the first data group which had additional laboratory test data, such as

hemoglobin and serum creatinine levels.

All data were then classified by nutritional status using NCHS/CDC 2000 curve,[10] by estimated glomerular filtration rate (eGFR) using Schwartz formula,[11] by blood pressure classification according to the Fourth Report on The Diagnostic: Evaluation and Treatment of High Blood Pressure in Children and Adolescent 2004,[12] and by hemoglobin level according to anaemia classification of World Health Organization.[13] Classification of nutritional status using NCHS/CDC 2000 curve were as followed: underweight was defined as BMI (body mass index) of <5th percentiles; normal weight was BMI between the 5th and 85th percentiles; overweight was BMI between 85th and 95th percentiles; and obesity was BMI of ≥95th percentiles.[10] Estimated glomerular filtration rate (eGFR) was calculated using Schwartz formula; eg. eGFR = [k x height (cm)/serum creatinine (mg/dL)] in mL/minute/1.73 m^2 BSA, with k is a constant which equals: 0.70 in boys 13-18 years of age and 0.57 in girls 13-18 years of age.[11] Normal kidney function was defined as eGFR >90 mL/minute/1.73 m^2, while decreased kidney function was defined as eGFR <90 mL/minute/1.73 m^2, which was divided to stage 1 (eGFR 60-89 mL/minute/1.73 m^2), stage 2 (eGFR 30-59 mL/minute/1.73 m^2), stage 3 (eGFR 15-29 mL/minute/1.73 m^2), and stage 4 (eGFR <15 mL/minute/1.73 m^2). Hypertension was determined based on age, sex, and height and was classified as followed: (1) Prehypertension: average of systolic blood pressure (SBP) and/or diastolic blood pressure (DBP) ≥90th and <95th percentile; (2) Stage 1 hypertension: average of SBP and/or DBP ≥95th percentile; (3) Stage 2 hypertension: average SBP and/or DBP >99th percentile+5 mmHg.[12] Hemoglobin level was classified according to anemia classification of the World Health Organization (WHO), and defined as anemia if hemoglobin (Hb) levels <13.0 g/dL in boys and <12.0 g/dL in girls.[13]

In this analysis, there were 52,454 subjects in the first data group and 2,151 subjects in the second data group. (**Figure 1**) The study results were managed electronically using SPSS (Statistical Product for Social Science) software version 17.0. Data were presented in narrative and tabular forms and were analysed descriptively.

RESULTS

The Basic Health Research year 2013 included 361,843 subjects aged 0-18 year, among them 56,409 (15.5%) adolescents aged 15-18 years, which were the subjects of this study. Combination of data questionnaires and physical examination (data group 1) obtained from 52,454 subjects. This first data group showed that there were 20,537 (39%) out of 52,454 subjects had kidney diseases. They consisted of 9,100 males and 11,437 females. Combination of data questionnaires, physical examination, and laboratory tests (data group 2) consisted of only 2,151 subjects. This second data group revealed that there were only 723 (33.6%) out of 2,151 subjects with kidney diseases, consisted of 334 males and 389 females. Data of laboratory tests showed that 2,128 subjects had hemoglobin level test and 1,920 had serum creatinine level test. Distribution of subjects are shown in **Figure 1**, while their baseline characteristics of subjects with kidney diseases are shown in **Table 1**. **Figure 2** showes the distribution of subjects with kidney diseases.

Table 2 shows that females who had a history of kidney disease and diagnosis of chronic renal failure were more prevalent than males, with proportion of 55.9% and 61.9%, respectively. Most of the subjects who had history of kidney disease (73.5%) and diagnosis of chronic renal failure (57.1%) had normal weight. The prevalence of hypertension among subjects who had history of kidney disease was higher than those who had diagnosis of chronic renal failure, which were 38.2% and 33.3%, respectively.

Table 3 shows that females with hypertension and prehypertension displayed higher prevalences than males. Most of the subjects with hypertension (79.9%) and prehypertension (86.1%) had normal weight.

Characteristics of subjects with decreased eGFR are shown in **Table 4**. There was no subjects with decreased eGFR who had previous diagnosis of hypertension, antihypertensive agents used, chronic renal failure, and the history of kidney stone disease. Most of the subjects who had decreased eGFR had normal weight (96.2%). The prevalence of hypertension in subjects who had decreased eGFR was 34.6%. There were 26

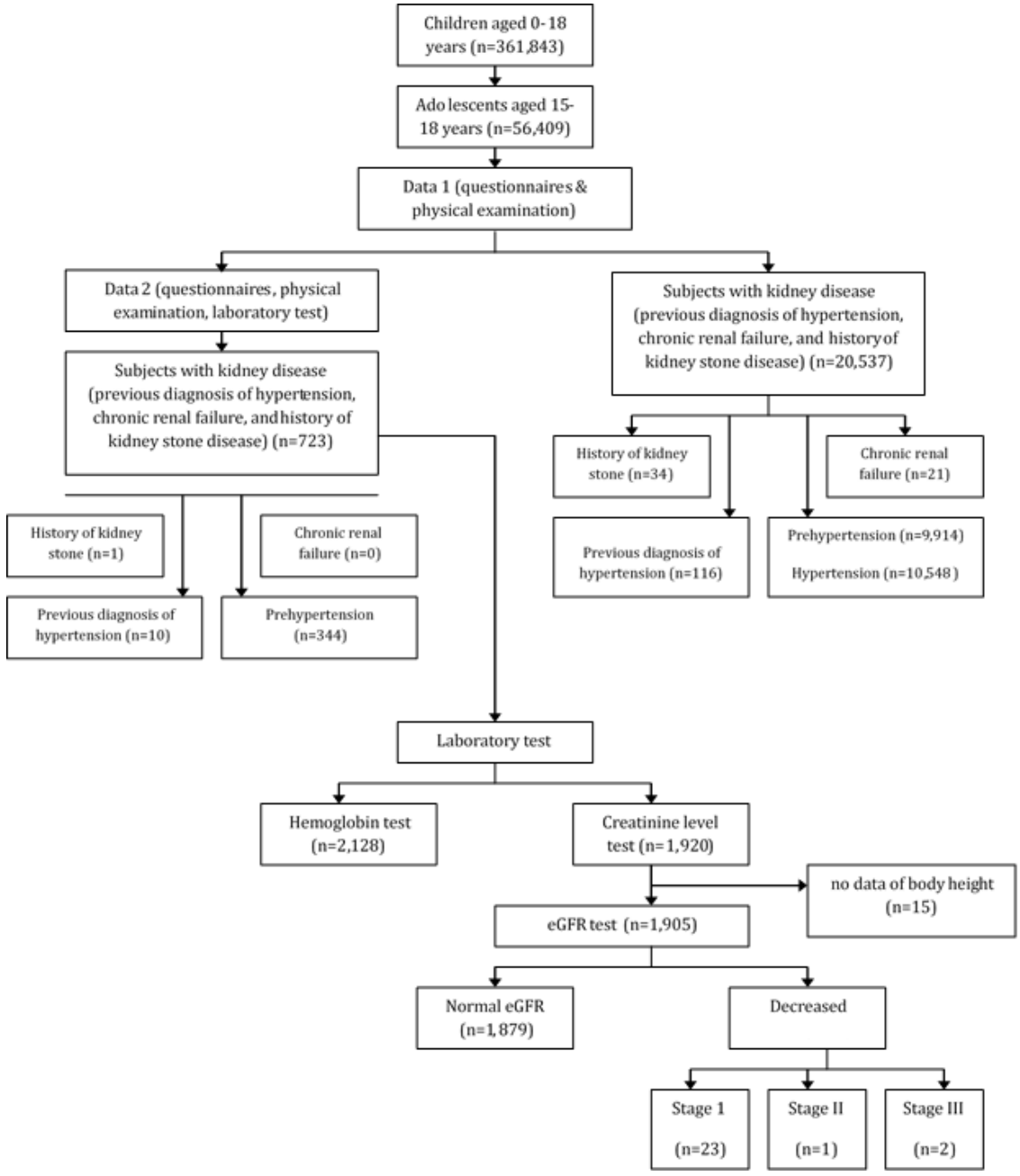

Figure 1. Data distribution of subjects

subjects who had decreased eGFR, comprising of stage I (23 subjects), stage II (one subject), end stage III (2 subjects). No subject was with decreased eGFR stage IV.

DISCUSSION

This study provides data about clinical profiles and characteristics of kidney disease among adolescents aged 15-18 years in Indonesia. In our study, prehypertension and hypertension were found in 51% and 48.3% of adolescents, respectively. Other studies conducted in America, Egypt, and Portuguese reported lower prevalence of hypertension 3%, 4%, and 12.1%, respectively.[14-16] These differences in prevalence of hypertension might be due to the differences of subjects' age. The American study included adolescents aged 12-19 years,[14] while the Egyptian study included adolescents aged 11-19 years,[15] the study in Portuguese was on adolescents aged 4-18

Table 1. Characteristics of subjects with kidney diseases

Gender, n (%)	Data 1 (n=20,537)	Data 2 (n=723)
- Male	9,100 (44.3)	334 (46.2)
- Female	11,437 (55.7)	389 (53.8)
Data from the questionnaires, n (%)		
- Previous diagnosis of hypertension	116 (0.6)	10 (1.4)
- Antihypertensive agents used	25 (0.1)	1 (0.1)
- Chronic renal failure	21 (0.1)	0 (0)
- History of kidney stone disease	34 (0.2)	1 (0.1)
Physical examination		
- Nutritional status, n (%)		
- Underweight	1,550 (7.5)	85 (11.8)
- Normal	17,064 (83.1)	576 (79.7)
- Overweight	1,293 (6.3)	43 (5.9)
- Obese	630 (3.1)	19 (2.6)
- Blood pressure, n (%)		
- Normal blood pressure	75 (0.3)	2 (0.3)
- Prehypertension	10,548 (51.4)	344 (47.6)
- Hypertension	9,914 (48.3)	377 (52.1)
- Stage I	9,079 (91.6)	352 (93.3)
- Stage II	835 (8.4)	25 (6.7)
Anemia, n (%)	---	125 (17.3)

Table 2. Characteristics of subjects with kidney diseases

Gender, n (%)	History of kidney stone disease (n=34)	Diagnosis of chronic renal failure (n=21)
- Male	15 (44.1)	8 (38.1)
- Female	19 (55.9)	13 (61.9)
Data from the questionnaires, n (%)		
- Previous diagnosis of hypertension	1 (2.9)	1 (0.9)
- Antihypertensive agents used	0 (0)	0 (0)
- Chronic renal failure	9 (26.5)	---
- History of kidney stone disease	---	9 (42.9)
Physical examination		
- Nutritional status, n (%)		
- Underweight	4 (11.8)	4 (19)
- Normal	25 (73.5)	12 (57.1)
- Overweight	3 (8.8)	2 (9.5)
- Obese	2 (5.9)	3 (14.3)
- Blood pressure, n (%)		
- Normal blood pressure	15 (44.1)	10 (47.6)
- Prehypertension	6 (17.6)	4 (19)
- Hypertension	13 (38.2)	7 (33.3)

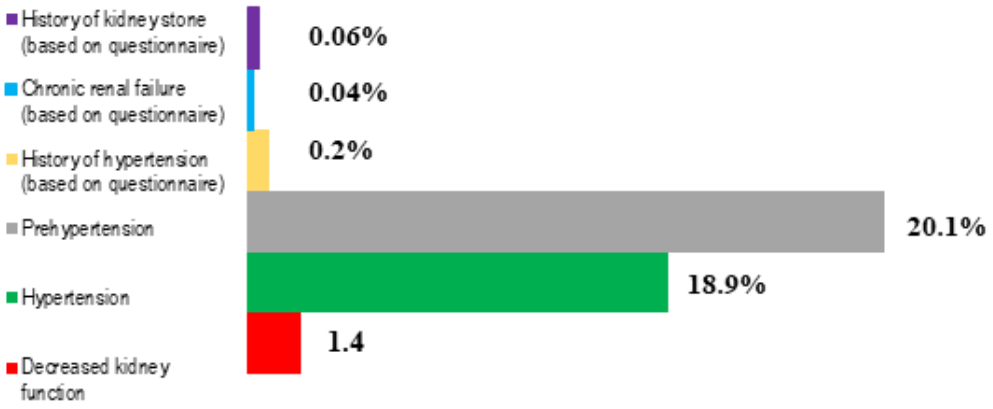

Figure 2. Distribution of kidney diseases among adolescents aged 15-18 years.

years.[16] Several factors might influence the higher finding subjects with hypertension in our study. The subjects' age in our study might presented a tendency of having a higher blood pressure due to essential hypertension which was more prevalent in adolesence.[17] Other factors are the difference in procedures and times in measuring the blood pressures. Other possible causes of elevated blood pressure, such as family history of hypertension, history of prematurity or low birth weight, dietary and life style habits, which were not observed.

Among 52,454 children in the first data group,

Table 3. Characteristics of subjects with hypertension and prehypertension

Characteristics	Hypertension (n=9,914)	Prehypertension (n=10,548)
Gender, n (%)		
- Male	4,663 (47)	4,412 (41.8)
- Female	5,251 (53)	6,136 (58.2)
Data from questionnaires, n (%)		
- Previous diagnosis of hypertension	42 (0.4)	22 (0.2)
- Antihypertensive agents used	15 (0.2)	8 (0.1)
- Chronic renal failure	7 (0.07)	4 (0.04)
- History of kidney stone disease	13 (0.1)	6 (0.1)
Physical examination		
Nutritional status, n (%)		
- Underweight	784 (7.9)	761 (7.2)
- Normal	7922 (79.9)	9083 (86.1)
- Overweight	758 (7.6)	528 (5)
- Obese	450 (4.5)	176 (1.7)
Blood pressure, n (%)		
- Stage I	9079 (91.6)	---
- Stage II	835 (8.4)	---

Table 4. Characteristics of subjects with decreased eGFR

Characteristics	Decreased eGFR (n=26)
Gender, n (%)	
- Male	5 (19.2)
- Female	21 (80.8)
Data from questionnaires, n (%)	
- Previous diagnosis of hypertension	0 (0)
- Antihypertensive agents used	0 (0)
- Chronic renal failure	0 (0)
- History of kidney stone disease	0 (0)
Physical examination	
Nutritional status, n (%)	
- Underweight	0 (0)
- Normal	25 (96.2)
- Overweight	0 (0)
- Obese	1 (3.8)
Blood pressure, n (%)	
- Normal blood pressure	4 (15.38)
- Prehypertension	4 (15.4)
- Hypertension	9 (34.6)
- Stage I	7 (26.9)
- Stage II	2 (7.7)
Laboratory examination	
eGFR <90mL/min/1.73m^2, n (%)	
- Stage I	23 (88.5)
- Stage II	1 (3.8)
- Stage III	2 (7.7)
- Stage IV	0 (0)
Anemia, n (%)	2 (7.7)

20,537 (39%) had kidney diseases with female predominance and normal weight. Hypertension has been found to be correlated to obesity in adults. In our study, only 7.6% of subjects with hypertension were overweight, while 4.5% of subjects with hypertension were obese. A study done in Turkey on children aged 5-18 years with hypertension found higher prevalence of overweight (11.4%) and obesity (7.6%).[18] A meta-analysis of 63 studies consisted of 49,220 children, revealed that systolic blood pressure was higher by 4.54 mmHg in overweight children, and by 7.49 mmHg in obese children.[19] A study in Turkey showed that increased body mass index was associated with lower eGFR.[3] The relationship between obesity and hypertension had been known, and these two factors highly contributed in decreasing kidney function. Hence, regular kidney function test is important to be performed in such high risk adolescents.

In our study, the prevalence of adolescents who had the history of kidney stone disease was 0.2%. An American hospital-based study showed the prevalence of children with kidney stone disease of 0.057%,[20] while a study in Iraq reported a higher result in children with the kidney stone (15%).[21] The prevalence of children with kidney stone disease varied in each country due to the geographical location. Several countries located on areas called the kidney stone belt, the areas that have higher rates of developing of kidney stones, had a higher incidence and prevalence of kidney stone disease.[22] Kidney stone disease might lead to development of CKD. A study reported that 1.6% of children with kidney stones developed into early-stage CKD and the prevalence of children with both kidney stone disease and CKD was about 26.5%.[23] Another study on 14,245 children with kidney stone

disease found that hypertension was one of the risk factors, especially in children under 10 years old.[24]

In our study, most of the subjects with kidney stone disease were well nourished, while overweight and obesity were in 8.8% and 5.9%, respectively. A study on 112 children reported that most children with kidney stone disease were also well nourished (49.1%).[25] Meanwhile, a study found that children with obesity and hypertension were more likely to have kidney stone disease (1.44 and 2.12 times, respectively).[26]

Based on the first data group, we found 0.1% of subjects who had chronic renal failure. Chronic renal failure in children has been known to be associated with poor growth and nutritional status. In our study, well nourished subject was more prevalent among subjects with chronic renal failure and decreased renal function. These findings were possibly due to the unknown onset of chronic renal failure. The earlier the onset of chronic kidney disease, the more the influence to nutritional status. Complications of chronic kidney disease, such as anorexia, metabolic acidosis, and anemia, contribute to the poor nutritional status.

In our second data group, there were 26 subjects (1.4%) with eGFR <90 mL/min/1.73 m^2. This finding was similar to the results of a community-based study done in Turkey (2007) on 3,079 subjects aged 14-18 years (1.2%).[3] However, a study in Italy on 1,197 children aged 0-16 years found the prevalence of children with eGFR <75 mL/min/1.73 m^2 of 0.007%.[27]

The prevalence of adolescents with kidney disease who also had anemia in our study was 17.3%. There are many factors contributing to anemia in CKD, such as the underlying disease, nutritional status, degree of kidney function, hematinic (e.g. iron, folic acid, vitamin B12, and B1) deficiency. A three-year cohort study found that there was a relationship between anemia and hypoalbuminemia with decreased GFR in children with CKD.[28] Moreover, anemia in kidney disease has been associated with the chronicity of the CKD.[29]

Our findings provide information about clinical profiles and characteristics of kidney disease among adolescents in the community. This information is valuable for estimating the socio-economic burden of kidney disease in Indonesia. On the other hand, this study conceives all limitations of secondary data. The subjectivity and the vulnerability to recall bias on the questionnaires were possibly found in our study. Another limitation of our study was that the blood pressures were measured only 2-3 times in a single time frame of examination and the size of the cuff being used for blood pressure measurement in our study also were not take into account.

The findings in this study reveals the specific adolescent health problem in Indonesia, meaning that this study results have limited generalisation, i.e. may generalised to countries with similar geographic-socio-demographic background.

CONCLUSION

Early detection of kidney disease in children is vigilant in initiating therapy and possibly reduce morbidity and mortality rates. Data regarding the prevalence of kidney disorders in adolescents is still limited in developing countries, especially in Indonesia. We found that the proportion of hypertension and prehypertension in adolescents aged 15-18 years in Indonesia is high. Therefore, routine blood pressure examination in children is essential in early detection of hypertension.

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