ORIGINAL ARTICLE

THE PREDICTING FACTORS FOR CHRONIC KIDNEY DISEASE AMONG HIGH RISK POPULATION IN LOWER NORTHERN, THAILAND

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ABSTRACT

This research aimed to explore the factors predicting chronic kidney disease (CKD) in the high-risk population. A cross-sectional study had been conducted in the high-risk populations investigated with and without CKD were the participants. A total of 1,463 samples was enrolled by a multistage sampling technique was used to recruit participants from five provinces in the lower northern of Thailand. Data were collected using a questionnaire and analyzed with descriptive statistics, and binary logistic regression. The results were revealed the risk factors affecting CKD including aged, dyslipidemia, being ill of diabetes mellitus, being unable to control blood pressure, being unable to control blood sugar level, taking add more salty seasoning to the cooked food, cooking with sodium salt over the prescribed amount, using the non-steroidal anti-inflammatory drug, lack of exercise, herbal plants consumption as drugs that are toxic to the kidney, edema, foamy urine, and nocturia. All risk factors were able to co-predict the risk to CKD about 83.2% at the 0.05 level of significance. Therefore, to prevent early states with CKD in the high-risk populations, the focus should be on encouraging health literacy because health literary it has a positive relationship with health-promoting behaviors. The health care provider needs to concentrate on increasing health literacy for self- management with them.

Keywords: Chronic kidney disease, high-risk population, Thailand

INTRODUCTION

Chronic kidney disease (CKD) is a serious health problem that has increased dramatically worldwide. CKD is a condition that has a strong relation to substantial morbidity, mortality, and economic loss. Approximately 13.4% of people globally are living with CKD[1, 2]. In Thailand, 8.4 million patients with CKD or 17.6% have been documented. Five levels of severity with estimated glomerular filtration rate, ranging from 1-5 were recorded as 3.3%, 5.6%, 7.5%, 0.8% and 0.3% of prevalence respectively. It was found that 79.3 % of patients were in the early stages (1-3) of CKD, while 20.7% of patients lived with late CKD stages (4-5)[3, 4]. The cost for treatment of CKD is relatively high, especially for patients who have renal replacement therapy[5, 6]. Consequently, the patients become pale, tired, weak, and could be infected easily, which could result in early death[7]. Concerning the quality of life, had a low quality of life and low self-esteem. They could not work as usual, which could affect their socio-economic status and negative societal impact. Moreover, it could have direct impacts on the caretakers due to time and income loss[8].

Chronic kidney disease has gradually increased in the high-risk population of diabetic and hypertensive patients, resulting in high morbidity as well as mortality. The CKD causes complications in diabetic and hypertensive patients[9, 10]. The Thailand kidney foundation also stages of CKD were unknown by 98% of the risk population[7]. Nevertheless, a high prevalence of stage-3 CKD could occur among five provinces i.e. Phetchabun, Phitsanulok, Sukhothai, Tak, and Uttaradit provinces in the lower northern part of Thailand[11]. Interestingly, those high-risk populations are unaware of the risk factors are and whether those factors can be or cannot be related to CKD.

Former research revealed that many risk factors influencing the CKD were likely to increase which may have different contexts from other regions[12, 13]. Examining the risk factors for a certain population of certain geographical settings could help to deal with the progression of CKD. Even though the risk factors in each region are varied. As mentioned above, we attempted to investigate the risk factors influencing CKD in the high-risk population living in five provinces of the lower northern region of Thailand. Therefore, the study aims to determine factors influencing chronic kidney disease among the high-risk population.

METHODS

A cross-sectional study was conducted between November 2018 to April 2019. Sample and setting: The population consisted of two main groups of people with diabetes mellitus and/or hypertension who were living in five major provinces located in the lower northern, Thailand for more than six months and

were chosen in this study. The sample size was calculated with the formula to estimate the finite population proportion[14]. The sample was enrolled by multistage sampling including stratified sampling, simple random sampling, and systematic sampling.

Inclusion criteria were as follows:
1) for cases: the high-risk groups who were diagnosed with CKD; 2) for controls: the high-risk groups who were diagnosed without CKD 3) samples who were willing to participate and 4) participants who were able to communicate in basic Thai language.

Exclusion criteria were as follows:
1) informants were sick during the interview; 2) informants left the research before completion and 3) all data from the interview was incomplete.

Ethical Considerations: Approval to conduct the study was gained from the Ethics Review Committee for Research Involving Human Research Subjects, by the human ethics committees of Naresuan University (No. 113/2018). Verbal consent was obtained from each potential participant prior to data collection. Each participant was informed regarding the purpose of study, and their rights to confidentiality and anonymity, as well as being able to terminate their study participation at any time with no effect on their hospital services.

Instruments: The questionnaire for data collection comprised a socio-demographic data form, risk behaviors and anxious behavior concerning sign and symptom. The questionnaire template consisted of questions concerning personal data and a personal factors-related character including the number of CKD i.e. age, gender, income, body mass index (BMI), waist circumference, duration of being diabetic, duration of being ill with high blood pressure, controlling blood sugar level, controlling the blood pressure level, gout, cardiovascular disease, anemia, kidney stone, dyslipidemia, benign prostatic hyperplasia, systemic lupus erythematosus and family history of kidney disease.

The risk behavior questionnaire followed the main work of Allen and Seaman[15] with slight modification. Three rating scales i.e. regularly (practicing every day or more than three times a week), sometimes (practicing less than or equal to 1-2 times a week) and hardly ever (never practice) were designed. Regarding the number of CKD, the risk factors affecting for CKD i.e. cooking with sodium salt over the prescribed

amount, using NSAIDs, herbal plants consumption that are toxic to the kidney, insufficient sleep, urinary incontinence, drinking less water, smoking, drinking alcohol, exercise and regular treatment are factors that could lead to chronic kidney disease in the high-risk population were also assigned. Additionally, for questionnaire involving the signs and symptoms, it was developed based on a literature review. Two major choices such as yes or no. i.e. edema (swollen of eyelids, face, feet or ankles), dysuria, turbid urine contains sand-like impurities, hematuria, foamy urine/proteinuria, and nocturia were included in this questionnaire form. Examining the quality of instrument: Item Objective Congruence Index was verified by five experts in the field of CKD in each item had IOC value between 0.5 and 1. A questionnaire had reliability value of 0.85.

Data collection: All respondents were interviewed and gathered by research assistants (RAs) who were trained for data collection from November 2018- April 2019. The procedures for human rights protection should be considered. The medical record review on each identified participant to collect personal data and other risk factors was conducted by RAs and those data obtained were reconfirmed by the principal investigator (PI).

Data analysis: Data were analyzed using descriptive statistics including percentage, frequency, mean, standard deviation, and minimum and maximum value. These statistics were used to explain the socio-demographic characteristics of the sample. Testing the relationship between the factors and CKD with the Chi-square test in the first step, testing the risk factors influencing CKD was performed using binary logistic regression analysis with the enter method. And tested to ensure the validity of the results with the stepwise method at the 0.05 level of significance.

RESULTS

Baseline characteristics
742 out of 1,463 participants were diagnosed as a patient with CKD (50.7%). Meanwhile, a total of 721 respondents were registered as the high-risk populations without CKD (49.3%) who have characteristics. The Socio-demographic characteristics showed that 66.5% were females. Most of them (77.4%) completed primary schooling, 57.3% aged 60 years and above with the mean of 63.3±12.2 years, and 50.7% were the risk population with CKD. The majority of them (64.0%) had income less than 5,000 THB. Almost half of them are being agriculturists (42.7%) (Table 1).

Table 1 General characteristics of respondents (n=1,463)

Characteristics	Totals (%)	CKD (%)	Non-CKD (%)
Gender			
Male	490 (33.5)	270 (36.4)	220 (30.5)
Female	973 (66.5)	472 (63.6)	501 (69.5)
Age (years)			
< 40	39 (2.7)	4 (0.5)	35 (4.9)
40-59	585 (40.0)	175 (23.6)	410 (56.9)
≥60	839 (57.3)	563 (75.9)	276 (38.2)
Education			
No study	122 (8.3)	75 (10.1)	47 (6.5)
Elementary	1132 (77.4)	625 (84.2)	507 (70.3)
High School	209 (14.3)	42 (5.7)	167 (23.2)
Main Job			
No occupation	555 (37.9)	391 (52.7)	164 (22.7)
Agriculturist	624 (42.7)	249 (33.6)	375 (52.0)
Employed	162 (11.1)	48 (6.5)	114 (15.8)
Official	122 (8.3)	54 (7.2)	68 (9.5)
Income per month			
< 5,000 (THB)	937 (64.1)	540 (72.8)	397 (55.0)
> 5,000 (THB)	526 (35.9)	202 (27.2)	324 (45.0)

The independent variables of personal factors including gender, age, income, waist circumference, diabetes mellitus, being ill of DM, being control DM, hypertensive, being ill of HT, being control HT, dyslipidemia, and kidney stone. Risk behaviors such as flavoring food with salt, flavoring food with diverse seasonings over 2,000 milligrams, NSAIDs Consumption, exercise, herbal consumption, smoking, anxious behaviors regarding signs and symptoms, for example, edema, anemia, dysuria, urine turbidity, hematuria, foamy urine, and nocturia. The details of these factors associated with CKD can be seen in table 2.

Table 2 Relationship between the risk factors and CKD with chi-square test (n=1,463)

Variable	Total	Non-CKD	CKD	χ^2	df	p-value
Gender				5.7	1	0.017*
Male	490 (33.5)	220 (30.5)	270 (36.4)			
Female	973 (66.5)	501 (69.5)	472 (63.6)			
Age (years)				319.2	5	< 0.001*
< 40	39 (2.7)	35 (4.8)	4 (0.5)			
40-59	585 (40.0)	410 (56.9)	175 (23.6)			
≥ 60	839 (57.3)	276 (38.3)	563 (75.9)			
Income per month				60.1	2	< 0.001*
< 5,000 (THB)	937 (64.1)	397 (55.1)	540 (72.8)			
≥ 5,000 (THB)	526 (35.9)	324 (45.0)	202 (27.2)			
BMI				6.5	1	0.011
< 25 kg/m^2	840 (57.4)	438 (60.7)	402 (54.2)			
≥ 25 kg/m^2	623 (42.6)	283 (39.3)	340 (45.8)			
Waist circumference (cm)				21.2	1	< 0.001*
Male < 90 Female < 80	680 (46.5)	379 (52.6)	301 (40.6)			
Male ≥ 90 Female ≥ 80	783 (53.5)	342 (47.4)	441 (59.4)			
Diabetes Mellitus (DM)				31.3	1	< 0.001*
No	799 (54.6)	447 (62.0)	352 (47.4)			
Yes	664 (45.4)	274 (38.0)	390 (52.6)			
Being ill of DM				126.6	2	< 0.001*
< 5 years	1,032 (70.5)	603 (83.6)	429 (57.8)			
5-10 years	216 (14.8)	75 (10.4)	141 (19.0)			
> 10 years	215 (14.7)	43 (6.0)	172 (23.2)			
Being control DM				107.0	1	< 0.001*
Control HbA1C ≤ 7 %	959 (65.6)	572 (79.3)	387 (52.2)			
Uncontrolled HbA1C>7 %	504 (34.4)	149 (20.7)	355 (47.8)			
Hypertensive (HT)				14.2	1	< 0.001*
No	172 (11.8)	108 (15.0)	64 (8.6)			
Yes	1291 (88.2)	613 (85.0)	678 (91.4)			

Table 2 Cont.

Variable	Total	Non-CKD	CKD	χ^2	df	p-value
Being ill of HT				102.7	2	< 0.001*
< 5 years	625 (42.7)	394 (54.7)	231 (31.1)			
5-10 years	511 (34.9)	231 (32.0)	280 (37.8)			
> 10 years	327 (22.4)	96 (13.3)	231 (31.1)			
Being control HT (mmHg.)				276.1	1	< 0.001*
Control BP <140/90	776 (53.0)	541 (75.0)	235 (31.7)			
Uncontrolled BP≥140/90	687 (47.0)	180 (25.0)	507 (68.3)			
Gout				14.0	1	< 0.001*
No	1,295 (88.5)	661 (91.7)	634 (85.4)			
Yes	168 (11.5)	60 (8.3)	108 (14.6)			
Cardiovascular disease				20.8	1	< 0.001*
No	1,351 (92.3)	689 (95.6)	662 (89.2)			
Yes	112 (7.7)	32 (4.4)	80 (10.8)			
Kidney stone				21.8	1	< 0.001*
No	1,365 (93.3)	695 (96.4)	670 (90.3)			
Yes	98 (6.7)	26 (3.6)	72 (9.7)			
Dyslipidemia				180.7	1	< 0.001*
No	646 (44.2)	446 (61.9)	200 (27.0)			
Yes	817 (55.8)	275 (38.1)	542 (73.0)			
Benign prostatic hyperplasia,				34.3	1	< 0.001*
No	1,421 (97.1)	719 (99.7)	702 (94.6)			
Yes	42 (2.9)	2 (0.3)	40 (5.4)			
Systemic lupus erythematosus				6.2	1	0.013*
No	1,453 (99.3)	720 (99.9)	733 (97.6)			
Yes	10 (0.7)	1 (0.1)	18 (2.4)			
Family history of kidney disease				57.5	1	< 0.001*
No	1,195 (81.7)	645 (89.5)	550 (74.1)			
Yes	268 (18.3)	76 (10.5)	192 (25.9)			
Taking add more salty seasoning to the cooked food				208.2	2	< 0.001*
Hardly ever	446 (30.5)	340 (47.2)	106 (14.3)			
Sometimes	757 (51.7)	316 (43.8)	441 (59.4)			
Regularly	260 (17.8)	65 (9.0)	195 (26.3)			
Cooking with sodium salt over				82.3	2	< 0.001*
Hardly ever	129 (8.8)	84 (11.6)	45 (6.1)			
Sometimes	818 (55.9)	464 (64.4)	354 (47.7)			
Regularly	516 (35.3)	173 (24.0)	343 (46.2)			
NSAIDs use				257.1	2	< 0.001*
Hardly ever	534 (36.5)	396 (54.9)	138 (18.6)			
Sometimes	724 (49.5)	308 (42.7)	416 (56.1)			
Regularly	205 (14.0)	17 (2.4)	188 (25.3)			
Exercise				205.2	2	< 0.001*
Regularly	236 (16.1)	173 (24.0)	474 (63.9)			
Sometimes	557 (38.1)	352 (48.8)	205 (27.6)			
Hardly ever	670 (45.8)	196 (27.2)	63 (8.5)			
Herbal plant consumption				111.2	2	< 0.001*
No	1,116 (76.3)	635 (88.1)	481 (64.8)			
Yes	347 (23.7)	86 (11.9)	261 (35.2)			
Smoking				44.7	2	< 0.001*
Non smoker	982 (67.1)	544 (75.5)	438 (59.1)			
Smoker	481 (32.9)	177 (24.5)	304 (40.9)			
Edema				175.6	2	< 0.001*
No	1,201(82.1)	689 (95.6)	512 (69.0)			
Yes	262 (17.9)	32 (4.4)	230 (31.0)			
Anemia				63.5	2	< 0.001*
No	1,369 (93.6)	712 (98.8)	657 (88.5)			
Yes	94 (6.4)	9 (1.2)	85 (11.5)			
Dysuria				44.1	2	< 0.001*
No	1,222 (83.5)	649 (90.0)	573 (77.2)			
Yes	241 (16.5)	72 (10.0)	169 (22.8)			

Table 2 Cont.

Variable	Total	Non-CKD	CKD	χ^2	df	p-value
Urine Turbidity				61.1	2	< 0.001*
No	1,315 (89.9)	693 (96.1)	622 (83.8)			
Yes	148 (10.1)	28 (3.9)	120 (16.2)			
Hematuria				76.0	2	< 0.001*
No	1,300 (88.9)	693 (96.1)	607 (81.8)			
Yes	163 (11.1)	28 (3.9)	135 (18.2)			
Foamy urine				327.5	2	< 0.001*
No	1,039 (71.0)	669 (92.8)	370 (49.9)			
Yes	424 (29.0)	52 (7.2)	372 (50.1)			
Nocturia				243.6	2	< 0.001*
No	802 (54.8)	542 (75.2)	260 (35.0)			
Yes	661 (45.2)	179 (24.8)	482 (65.0)			

* P-value < 0.05

Factors affecting CKD

The result showed that the thirteen risk factors of CKD were divided into four groups as follows;

1) socio-demographic data including aged between 40-59 years (AOR = 3.84, 95%CI = 1.03-14.29, P-value = 0.045), 60 years and above, (AOR = 12.07, 95%CI = 3.25-44.83, P-value <0.001)

2) history of the illness as dyslipidemia (AOR = 1.56, 95%CI = 1.14-2.13, P-value = 0.006), being ill of DM between 5-10 years (AOR = 2.20, 95%CI = 1.35-3.59, P-value = 0.002), illness above 10 years (AOR = 2.48, 95%CI = 1.42-4.31, P-value = 0.001), uncontrolled blood sugar level (AOR = 1.59, 95%CI = 1.05-2.41, P-value = 0.030), and uncontrolled blood pressure (AOR = 3.20, 95%CI = 2.34-4.38, P-value <0.001

3) health behavior such as taking add more salty seasoning (AOR = 3.15, 95%CI = 1.87- 5.32, P-value <0.001), flavoring food with diverse seasonings (Na+) over (AOR = 2.87, 95%CI = 1.66-4.98, P-value <0.001), using NSAIDs as regularly (AOR = 3.49, 95%CI = 1.78-6.82, P-value <0.001) moreover, lacking of exercise (AOR = 3.46, 95%CI = 2.19- 5.45, P-value <0.001), applying herbal plants as drugs that are toxic to kidney (AOR = 1.73, 95%CI = 1.24-2.40, P-value = 0.001), and

4) sign and symptoms as edema (AOR = 2.51, 95%CI = 1.62-3.89, P-value <0.001), foamy urine (AOR = 3.01, 95%CI = 1.98-4.58, P-value <0.001)and nocturia (AOR = 1.62, 95%CI = 1.18-2.24, P-value = 0.003) at the 0.05 significant level as demonstrated in Table 3. All risk factors were able to co-predict to CKD about 83.2% at the 0.05 level of significance.

DISCUSSION

The results showed the thirteen independent significant risk factors of CKD among the high-risk population in the lower northern, Thailand as follows:

Age is a risk factor[16, 17] reported that people aged more than 40 years old had a higher risk of CKD than people who were younger than 40 years old by 1.80 times[16].

Participants with dyslipidemia proposed that people who had high LDL- and low HDL-cholesterol could be at high risk for CKD[18] because dyslipidemia could cause atherosclerosis thereby delaying the stimulation of the kidney's function. This case was also conformed to Xue, et al (2014)[19] who claimed that the risk was about 1.30 times.

Duration of diabetic mellitus (DM), patients with DM over a prolonged period could cause inflammation of the blood vessels resulting in retarding the blood flow to the kidneys, ultimately leading to renal disease[10, 20].

Uncontrolled blood sugar level (HbA1c >7 %) was related to the CKD (1.59 times). Abnormal blood sugar levels could make the blood to be more viscous, hampering its smooth flow to the kidneys, resulting in kidney failure[17, 21]. Uncontrolled blood pressure was potential to increase about 3.20 times due to the high blood pressure that could bump up until the blood vessels narrow, resulting in insufficient blood flow to the kidney[19, 22].

Add more salty seasoning to the cooked food, for instance, fish sauce with chili and sauce showed the health behavior salt intake, and many people unknown and aware. In addition, and cooking with sodium salt over the prescribed amount related to the CKD[23, 24]. could easily cause water retention, resulting in renal disease. Koh, et al. (2011)[25] reviewed that reducing Na+ concentration by about 20 mmol a day could

Table 3 Multivariate analysis between risk factors affecting the Chronic Kidney Disease (n=1,463)

Variable	AOR	95% CI	P- value
Age			
<40 years	1.00		
40-59	3.84	1.03-14.29	0.045*
≥ 60	12.07	3.25-44.83	< 0.001*
Dyslipidemia (yes=1, no=0)	1.56	1.14-2.13	0.006*
Duration of DM)< 5 years=0(			
5-10	2.20	1.35-3.59	0.002*
> 10	2.48	1.42-4.31	0.001*
Blood pressure) uncontrolled=1, control=0(	3.20	2.34-4.38	< 0.001*
HbA1C) %) (uncontrolled=1, control=0(	1.59	1.05-2.41	0.030*
taking add more salty seasoning			
Hardly ever	1.00		
Sometimes	1.50	1.03-2.19	0.034*
Regularly	3.15	1.87-5.32	< 0.001*
cooking with sodium salt over the prescribed amount			
Hardly ever	1.00		
Sometimes	2.08	1.25-3.46	0.005*
Regularly	2.87	1.66-4.98	< 0.001*
NSAIDs Use			
Hardly ever	1.00		
Sometimes	1.41	1.00-2.00	0.048*
Regularly	3.49	1.78-6.82	< 0.001*
Exercise			
Regularly	1.00		
Sometimes	1.59	1.01-2.50	0.046*
Hardly ever	3.46	2.19-5.45	< 0.001*
Herbal consumption(yes=1, no=0)	1.73	1.24-2.40	0.001*
Edema (yes=1, no=0)	2.51	1.62-3.89	< 0.001*
Foamy urine/proteinuria (yes=1, no=0)	3.01	1.98-4.58	< 0.001*
Nocturia (yes=1, no=0)	1.62	1.18-2.24	0.003*

* P-value < 0.05

Regular use of non-steroidal anti-inflammatory drugs (NSAIDs) was associated with CKD.

postulated that taking NSAIDs had a higher risk for CKD around 1.2 times[3]. Using NSAIDs for a long period could cause accumulation in the

kidney due to excretion and synthesis of prostaglandins is halted, resulting in Na+ congestion[26].

Lack of exercise was a risk factor for CKD. People who have sometimes or never exercised had increased risks of CKD around 1.59 and 3.46 times when compared with people who have exercised regularly. Regular exercise could assist the circulatory system to increase blood flow, reinforcing the kidneys. Previous research reported that the glomerular filtration rate after exercise was 3 times of usual rate[27].

Herbal plant consumption that is relatively toxic to kidneys could be a risk for CKD. The patients with DM or hypertension, who use herbals by boiling and drinking such as East Indian crew tree (Helicteres isora), Bitterleaf tree (Gymnanthemum extensum), Blue trumpet (Thunbergia laurifolia), Great morinda (Morinda citrifolia), River spiderwort (Tradescouldtia fluminensis), Cat's whiskers (Orthosiphon aristatus) and use of bolus. The medicines to reduce blood sugar or blood pressure are usually done for a long period effecting kidney failure[4, 28].

However, the sign and symptoms such as edema[29], the urinary foam/proteinuria[30], and nocturia[31] related to the CKD. these signs and symptoms caused by kidney failure. Similarly, this could cause the water to be expelled from the body and more often than usual. It had been recorded that age could be a risk factor of about 1 time. Meanwhile, the CKD stage could be a risk factor of about 1.5 times. Besides, about 64.0% of clinical significance in patients with CKD was also explored[31].

The researchers have some limitations. Our design was a cross-sectional study and conducted the data with only the five provinces in the lower northern, Thailand.

In order, to prevent early states with CKD in patients with type2 diabetes and hypertension, the focus should be on encouraging health literacy because health literary has a positive relationship with health-promoting behaviors. The health care provider needs to concentrate on increasing health literacy for self-management with them.

In further research, develop health literacy for prevention the risk of CKD among the high-risk population.

CONCLUSION

In conclusion, the thirteen risk factors affecting the CKD among the high-risk population divide into four groups including 1) socio-demographic consists of age, 2) history of the illness such as dyslipidemia, duration of diabetes mellitus, uncontrolled blood sugar, and blood pressure, 3) health behavior as follows adding salty condiments on the cooked, cooking with sodium salt over, using the non-steroidal anti-inflammatory drug, lack of exercise, herbal plants consumption, and 4) sign and symptoms such as edema, urinary foam/proteinuria, and nocturia.

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