Original research

Analysis of differences in early detection of chronic kidney disease with urine creatinine, proteins and individual health status based on behavioural, stress and genetic factors in Kendari City, Indonesia

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Abstract

Background: Early detection of chronic kidney disease needs to be developed because the prevalence of chronic kidney disease continues to increase in Kendari City, Indonesia.

Objective: The study aimed to analyse of differences in early detection of chronic kidney disease with urine proteins, creatinine, and individual health status based on behaviours, psychological-stress environment and genetic factors in Kendari City, Indonesia.

Methods: This research used quantitative method with a cross sectional study approach. This study was conducted in Kendari City, Southeast Sulawesi, Indonesia, which recruited 136 subjects aged between 24-70 years. The participants were interviewed and tested urine. The dependent variables are protein-urine, creatinine, and health status. The independent variables are behaviours, psychological environment-stress and genetics. Data analysis used multinomial logistic regression statistical tests.

Results: This study suggests that there are differences between tests for urine protein levels, creatinine and individual health status for early detection of chronic kidney disease which is associated with behaviours, psychological-stress environment and genetic factors in Kendari City. Protein-urine can be used early detection of chronic kidney disease which is related to daily water consumption (p=0.001, OR=1.56), calory intake (p=0.036, OR=2.13) and psychological stress environment (p=0.017, OR=0.11). However, urine creatine test cannot be use for early detection of chronic kidney disease. Meanwhile, individual's health status can be used to early detection of chronic kidney disease with relating to daily water consumption behaviour of less than 1000 ml a day (p<0.0001, OR=1.56), physical activity (p<0.05, OR=5.7), medication adherence (P<0.01, OR=0.4), and psychological stress environment (p<0.0001, OR=8.6).

Conclusion: Early detection of chronic kidney disease may be more effective by observing health status directly, or by urine protein testing, compared to urine creatinine testing.

Keywords: Chronic kidney disease; behavior; genetic, stress; proteins

Background

Chronic Kidney Disease (CKD) is a risk factor for cardiovascular disease and is a "Silent killer", including in Kendari City, Southeast Sulawesi Indonesia (Bellasi et al., 2019; Cibulka & Racek, 2007; Lewington et al., 2013; Marreiros et al., 2022; Provenzano et al., 2019) This disease has contributed to death in adults. The prevalence appears to be low, but the underlying diseases such as hypertension and diabetes mellitus are very high. In 2018, the prevalence of CKD in Southeast Sulawesi Province, such as in Kendari city was 0.35%, but there was an increase compared to 2013 (0.2%) (Kementerian Kesehatan R.I., 2013, 2019). Diseases that include a high risk of chronic kidney disease are hypertension and diabetes mellitus (Afera et al., 2021; Indrayani & Utami, 2022).

As is known that, the prevalence of hypertension in Kendari City is 74.83% and Diabetes Mellitus (DM) is 72.96%. This prevalence is very high when compared with the average in Southeast Sulawesi Province, namely 41.04% for hypertension and 64.48% for DM (Health Department of Southeast Sulawesi Province., 2022). If hypertension and diabetes mellitus (DM) do not receive proper and routine treatment, they will trigger a high prevalence of chronic kidney disease (Afera et al., 2021; Health Department of Southeast Sulawesi Province., 2022; Hustrini et al., 2022; Indrayani & Utami, 2022; Tasnim & Sunarsih, 2022). Treatment for chronic kidney disease is very expensive, sufferers must undergo haemodialysis or kidney transplantation (Fassbinder et al., 2015; Provenzano et al., 2019; Valentim et al., 2013). Therefore, controlling chronic kidney disease is very important and one of them is early detection.

However, how to carry out early detection of chronic kidney disease has not been clearly defined. The preliminary study with 10 patients with kidney failure at Bahteramas Hospital in April 2023 found that 85% of patients did not drink enough water, 80% worked sitting more than 6 hours a day, 90% ate irregularly, 90% rarely took hypertension medication, 80% were stressed with working conditions, and 35% have a family history of diseases such as hypertension, diabetes and kidney disease. These initial studies suggest that behavioral, stress and genetic factors may be determinants of chronic kidney disease.

Several studies also have stated that poor diet, drinking not enough water, irregular medication, lack of physical activity and a family history of illness affect individual health, including chronic kidney disease (Mallamaci & Anna Pisano, 2020; Notaras & Conti, 2018; Sato et al., 2015). However, whether these variables can be used as parameters for implementing early detection in chronic kidney disease has not been clearly formulated. Moreover, what types of laboratory tests are effective for detecting kidney disease? whether with creatinine, protein or simply by looking at health status and in this case, it is also not clearly stated. Therefore, this study aims to analyse differences in early detection of chronic kidney disease using urine protein, creatinine tests, individual health status which are associated with behaviours, psychological-stress environment and genetic factors in Kendari City, Southeast Sulawesi Province, Indonesia.

Method

Study design
This research uses quantitative methods with Cross Sectional Study Design. Urine protein levels, urine creatinine and health status are dependent variables. Meanwhile, behaviour, psychological environment, stress and genetics are independent variables. Behavioural factors include water consumption, calorie intake, herbal consumption, medication adherence, and daily physical activity.

Settings
This research was carried out in three sub-districts, namely Kendari, Baruga, and Abeli sub-districts in Kendari City, Southeast Sulawesi Province, Indonesia. The selection in the three sub-districts was based on geographical representation and regional characteristics in the Kendari City area. Baruga District is the largest sub-district in Kendari City, namely 44.38 Km2, while Sub-District has 17.28 Km^2, and Abeli District has 16.06 Km^2 (BPS-Statistics of Kendari Municipality, 2023). Baruga District is a land area in the southeastern part of Kendari City. Kendari District is an urban area. Meanwhile, Abeli District is a coastal area in the Kendari City area.

Data collection was carried out at four Community Health Centres and three hospitals from June to August 2023. The independent variables in this research are behavioral factors, psychological environmental stress, and genetic factors. Behaviour factors include daily drinking water consumption, daily calorie intake, herbal consumption, daily physical activity, and compliance with taking medication. The

dependent variables in this study are urine protein levels, urine creatinine, and health status. The categories of each variable are explained in **tables 1.**

Sample/Participants

The population is people aged 20-65 years and over who suffer from kidney disease in 2022 in Kendari City, namely 206 people. By using the Slovin formula with 95% confidence interval, so the sample size in the study was 136 people. The sampling technique used accidental sampling technique. Inclusion criteria for the sample were being willing to be interviewed and have a urine sample taken, not experiencing communication problems, not being seriously ill.

Instrument

Data was collected by interviewing with a questionnaire, taking urine samples and blood pressure. Based on the validity and reliability test with df 134, 5% of confidence interval level and r table = 0.168, it is shown that the corrected item total correlation value for all factors in the instrument is declared valid, namely with a range between 0.469 to 0.677. The Cronbach's Alpha results also show reliability, namely with a range between 0.432 to 0.646

Intervention

This study did not provide intervention, participants were only asked to take urine samples which were then tested for protein and creatinine levels. The procedure for taking a urine sample is to start by giving a 5 ml urine pot, then the respondent was asked to urinate approximately 4-5 ml into the urine pot. Then the urine was checked in less than 24 hours in Clinical Laboratory in Mandala Waluya University. Urine examination used random urine examination methods, both directly and microscopically. Direct inspection by looking at the level of clarity, odor, colour, and whether it was foamy or not. Protein and creatinine analysis using Urit 13G Urine Reagent Strip. Categories of protein and creatinine levels in urine are explained in **table 1**.

Data analysis

Data analysis uses Multinomial Logistic Regression statistical analysis, with a significance level of 95% or alpha 0.05. Data were processed with SPSS version 25.

Ethical consideration

This research was conducted after obtaining Ethical approval from the ethical committee of Mandala Waluya, Indonesia, with protocol number 023/KEP/UMW/VI/2023, in June 19th 2023. Participants were asked for their approval by signing an informed consent. Participant data is anonymous and guaranteed confidentiality as stated in the informed consent before they participate in this research.

RESULTS

This research has analysed data from 136 respondents, most of whom were women (60.3%) and only 39.7% were men. Age of respondents Most were in the 51–60-year age group (30.1%) and least in the 36–40-year age group. Subjects in the 41–50-year age group were also the second largest (27.2%). The rest were in the age group less than 35 years (17.6%) and more than 60 years (15.4%). The subject's education level is dominated by those with a high school education (33.8%) and the lowest are those with a doctoral degree (0.7%) and a master's degree (5.1%). Then followed by the second largest, namely Bachelor (28.7%). Meanwhile, the proportion of subjects with primary school and junior high school education was the same (13.2%). However, there were 2.2% of subjects who did not complete elementary school.

Half of the subjects were unemployed or housewives and retired (50%). The second largest proportion is civil servants (21.3%) followed by private sector workers (13.2%). Only a few subjects worked as farmers (3.7%) and labourers (2.2%)

Descriptive analysis results

The results of urine examination from 136 respondents showed that the subjects' urine protein levels were dominated by normal urine protein levels (48.5%), but most of them had high creatinine levels, namely above 8.8 mmol/L, namely 84.6% **(Table 1).** Meanwhile, their health status is dominated by acute and chronic kidney sufferers (39.0%).

Most of the subjects did not consume enough drinking water every day, namely less than 1000 ml per day (64.0%) **(Table 1).** For the subject's diet, the majority of daily calorie intake is in the medium category, namely between 768-1533 calories per day (61.8%). Most subjects did not consume herbal medicine (60.3%). Meanwhile, almost half of the subjects' physical activity was low or less than 4 hours a day (50.0%). More than 71% of subjects complied with taking medication for their health. The level of stress in the psychological environment of the subjects was dominated by those who were normal (59.6%) and had no family history of acute or chronic kidney disease (92.6%).

Table 1. Distribution of behavioural factors, psychological environment-stress, genetics, urine protein, creatinine and health status

Variable	Categories	N	Marginal Percentage
X1. Consume drinking water a day	Good (>2000 ml)	7	5.1%
	Medium (1000-1999 ml)	42	30.9%
	Less (<1000 ml)	87	64.0%
X2. Calorie Intake a day	Good (> 1534 calories/ cal.)	11	8.1%
	Medium (768-1533 cal.)	84	61.8%
	Less (< 767 cal.)	41	30.1%
X3. Herbal consumption	No	82	60.3%
	Yes	54	39.7%
X4. Daily physical activity	Normal (5-8 hours/hr)	45	33.1%
	High (> 9 hr)	23	16.9%
	Low (< 4 hr)	68	50.0%
X5. Compliance medication	Obey	97	71.3%
	Not obey	39	28.7%
X6. Psychological-stress Environment	Normal (<11)	81	59.6%
	High (12-22)	41	30.1%
	Low (23-32)	14	10.3%
X7. Genetic	No	126	92.6%
	Yes	10	7.4%
Y1. Proteinuria	Normal	66	48.5%
	Low (<+ 0.3)	19	14.0%
	Medium (+0.4 - +1.0)	26	19.1%
	High (> ++2.0)	25	18.4%
Y2. Creatinine Uria	Low (0.9 mmol/L)	2	1.5%
	Medium (4.4 mmol/L)	19	14.0%
	High (> 8.8 mmol/L)	115	84.6%
Y3. Health Status	Healthy	16	11.8%
	Single disease	40	29.4%
	Multiple diseases	27	19.9%
	Acute/ chronic kidney disease	53	39.0%
	Total	**136**	**100.0%**

Inferential Analysis Results
The results of the multinomial logistic regression statistical test stated that only daily water consumption, daily calorie intake and psychological-stressful environment had a significant effect on high levels of proteinuria **(Table 2).** Daily drinking water consumption has a negative effect, which means that the lower the daily drinking water consumption, namely less than 1000 ml a day, the higher the subject's proteinuria level. The odds ratio for daily drinking water consumption is 1.56. This means that if you consume less than 1000 ml of water a day, you will have a risk of 1.56 times higher urine protein levels. Likewise, the direction of daily calorie intake is also negative. This means that the less the subject's daily calorie intake, the more likely the protein level is to be high. Meanwhile, the Odds Ratio is 2.13, which means that the lower the daily calorie intake, the higher the risk of high levels of proteinuria. The stressful psychological environment influences protein-urine levels, but it is not a risk factor for high protein urine levels.

Early detection of chronic kidney disease with use urine protein levels which is associated with behavioural factors, psychological environmental stress, and genetic factors in Kendari City.

Table 2. Influence of behavioural factors, psychological environment and genetics on proteinuria levels

Variables	-2 Log Likelihood	Likelihood Ratio Tests			Wald	B	Exp(B)
		Chi-Square	df	Sig.			
Intercept	206.417[a]	0.000	0	.			
X1. Consume drinking water a day	232.064	25.647	6	0.000			
Good (>2000 ml)				-	-	-20.276	1.56
Medium (1000-1999 ml)				0.006	7.700	-2.270	0.103
Less (< 1000 ml)				0[b]	0[b]	0[b]	0[b]
X2. Calorie Intake a day	219.921	13.504	6	0.036			
Good (> 1534 cal.)				-	-	-19.969	2.127
Medium (768-1533 cal.)				0.298	1.084	-0.624	0.536
Less (< 767 cal.)				0[b]	0[b]	0[b]	0[b]
X6. Psychological-stress environment	221.803	15.386	6	0.017			
Normal (<11)				0.011	6..465	-2.193	0.112
Light (12-22)				0.241	1..377	-1.046	0.351
Medium (23-32)				0[b]	0[b]	0[b]	0[b]

Note: [a] This reduced model is equivalent to the final model because omitting the effect does not increase the degrees of freedom. [b] Reference category, [c] This statistical analysis uses Multinomial Logistic Regression test, with a significance level of 95% (alpha=0.05)

Early detection of chronic kidney disease with use urine creatinine levels which is associated with behavioural factors, psychological environmental stress, and genetic factors in Kendari City.

Table 3. Influence of behavioural factors, psychological environment and genetics on creatinine levels

Variables	Likelihood Ratio Tests			
	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept	71.905	.000	0	.
X1. Consume drinking water a day	75.737	3.833	4	.429
X2. Calorie Intake a day	74.385	2.480	4	.648
X3. Herbal consumption	75.175	3.270	2	.195
X4. Daily physical activity	76.790	4.886	4	.299
X5. Compliance medication	75.486[b]	3.582	2	.167
X6. Psychological-stress environment	80.635	8.731	4	.068
X7. Genetic	72.318	.414	2	.813

Note; This statistical analysis uses Multinomial Logistic Regression test, with a significance level of 95% (alpha=0.05)

The results of the multinomial logistic regression statistical test showed that all behavioural factors, environmental psychological stress and genetic factors had no significant effect on the subjects' urine creatinine levels **(Table 3).**

Early detection of chronic kidney disease with use individual health status which is associated with behavioural factors, psychological environmental stress, and genetic factors in Kendari City.

Multivariate analysis with a multinomial logistic regression test showed that there were 4 variables that had a significant effect on the subject's health status. These four variables are daily drinking water consumption (p value < 0.0001), daily physical activity (p value < 0.05), compliance with taking medication (p value < 0.01), and psychological stress environment (p value < 0.0001) (Table 4). The less than 1000 ml of drinking water consumed per day, the worse the subject's health status, namely leading to chronic kidney disease. The risk of not drinking enough water a day is 85.6 times. This means that subjects who drink less than 1000 ml a day are 85.6 times more likely to develop chronic kidney disease compared to those who drink more than 2,000 ml of

water a day. Likewise with physical activity behaviour, the less than 5 hours a day, the worse the subject's health status will lead to chronic kidney disease. Where subjects whose physical activity was less than 5 hours a day had a 5.7 times risk of suffering from chronic kidney disease compared to those who did more than 8 hours a day.

Table 4. Influence of behaviour, psychological environment and genetics on health status

| Variables | -2 Log Likelihood | Likelihood Ratio Tests | | | | | |
		Chi-Square	df	Sig.	Wald	B	Exp(B)
Intercept	178.727[a]	0.000	0	.			
X1. Consume drinking water a day	216.101	37.374	6	0.000			
Good (>2000 ml)				0.997	0.000	20.078	-
Medium (1000-1999 ml)				0.000	13.048	4.450	85.599
Less (< 1000 ml)				0[b]	0[b]	0[b]	0[b]
X4. Daily physical activity	195.202	16.474	6	.011			
Normal (5-8 hours)				0.046	4.000	1.735	5.667
High (> 9 hours)				0.332	0.943	1.054	2.869
Low (< 4 hours)				0[b]	0[b]	0[b]	0[b]
X5. Compliance medication	192.088	13.360	3	0.004			
Obey				0.042	4.143	1.999	7.378
Not obey				0[b]	0[b]	0[b]	0[b]
X6. Environmental psychology Stress	204.741	26.014	6	.000			
Normal (<11)				0.100	2.702	2.151	8.595
Light (12-22)				0.660	0.194	-0.660	0.517
Medium (23-32)				0[b]	0[b]	0[b]	0[b]

Note: [a] This reduced model is equivalent to the final model because omitting the effect does not increase the degrees of freedom. [b] Reference category; [c] This statistical analysis uses Multinomial Logistic Regression test, with a significance level of 95% (alpha=0.05)

Compliance with taking medication shows that the more non-compliant you are with taking medication, the worse your health status will lead to chronic kidney disease. The risk for subjects who do not comply with taking medication is 7.4 times compared to those who comply.

Psychological environmental factors of stress also show that the more severe an individual's stress level, the worse their health condition will be, leading to chronic kidney disease. The risk of increasingly severe stress is 8.6 times the risk of chronic kidney disease, compared to those without stress. However, the estimation of the category parameters shows that mild stress is not a risk factor for the subject's health status.

The differences of Early detection for chronic kidney disease in the Kendari City based on behaviour, psychological-stress environment and genetics factors

Figure 1. Early detection for chronic kidney disease based on urine proteins levels and individual's health status in the Kendari City
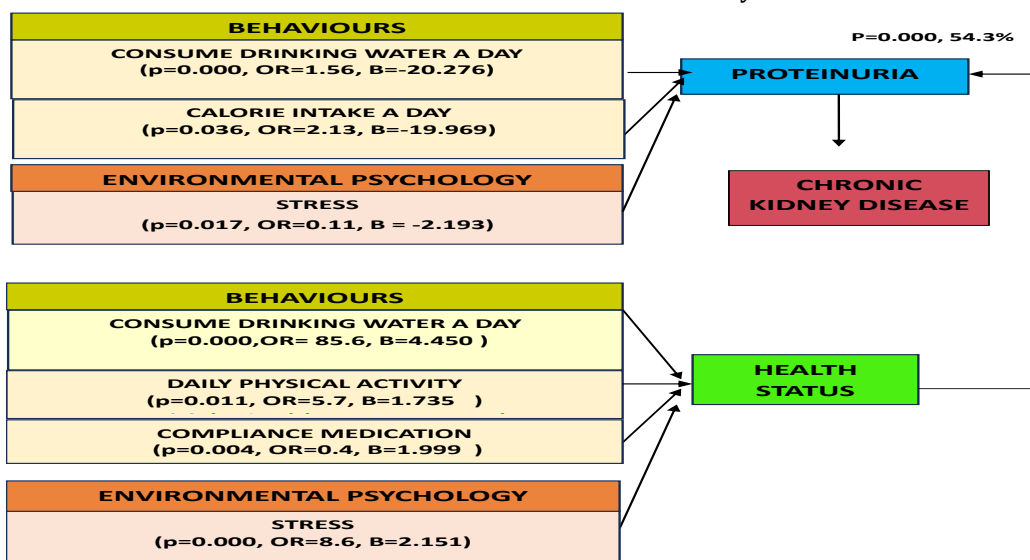
The early detection model is formulated as below. That behavioural factors and environmental psychological stress can be used as early detection for chronic kidney disease **(Figure 1).** Parameters for early detection by testing protein urine levels can use behavioural factors such as drinking less than 1000 ml of water a day, food intake of less than 1534 calories a day, and the more severe the stress, the higher the urine protein level. Meanwhile, the parameters for early detection without laboratory tests are using behaviours such as consuming less than 1000 ml of water a day, physical activity for less than 4 hours, non-compliance with taking medication and the more severe the stress, the higher the risk of chronic kidney disease.

DISCUSSION

The behaviour of consuming less than 1000 ml of water a day, calorie intake of less than 1534 calories a day, physical activity of less than 4 hours a day, non-compliance with taking medication and stress can be used as indicators in early detection of chronic kidney disease. Lack of consuming less than 1000 ml of water a day results in disturbed metabolic processes and fluid balance in the body. Water is a nutritional element that helps dissolve various chemical substances in the body (Putri & Faudah Z, 2020). At least 70% of the fluids in the human body are needed, especially the brain and blood. Lack of fluids in the body results in an imbalance between what goes in and what goes out, so that the body will experience dehydration (L. E. Armstrong, 2012). Mild dehydration results in changes in an individual's physiology and behaviour (L. E. Armstrong, 2012). Mild dehydration is said to interfere with a person's cognition and mood swings (L. Armstrong et al., 2012; Ganio et al., 2011) Meanwhile, moderate and severe dehydration results in loss of body mass (Cian et al., 2000, 2001) Previous studies also stated that consuming small amounts of drinking water also increases the risk of renal lithiasis including urinary tract infections (Cian et al., 2001). On the other hand, increasing drinking water consumption can reduce the risk of kidney stones.

The body also needs calories to provide energy to carry out daily activities. A calorie intake of less than 1534 calories is stated to have caused disruption in kidney function, namely by increasing urine protein levels. For adults, the recommended calorie needs are around 2100 calories for women and 2500 calories for men. Several studies state that calorie restriction is not a problem for health, only weight loss, but can improve the quality of life, especially for those who are obese (Martin et al., 2016). This is in line with current research, where during multivariate analysis, it was proven that calorie intake did not have a significant effect on health status This is in line with current research, it was proven that calorie intake did not have a significant effect on health status, but calorie deficiency increased urine protein levels. Calorie restriction has also been shown to promote metabolic adaptation, reduction of oxidative damage, and release of fat and fat mass, which ultimately reduces physiological function associated with age (Most & Redman, 2020). Physiological decline in the form of weight loss, decreased insulin secretion, typhoid and leptin concentrations, and increased mitochondrial energy efficiency. A slight reduction in calorie intake can improve metabolic health and physical health (Peters et al., 2022).

Physical activity has also shown significant differences between healthy individuals, single disease, multiple disease and chronic kidney sufferers. Normal physical activity is between 5-8 hours a day. Meanwhile, women and men whose physical activity is low or under 4 hours a day, can both affect the glomerular rate or impaired kidney function (Hawkins et al., 2011). Another study states that a lack of physical activity for women results in rapid aging and the risk of comorbidities (Wilkinson et al., 2021). Low physical activity also has an impact on lipid metabolism disorders, so that this condition accelerates the occurrence of chronic diseases (Hamilton et al., 2007). Conversely, increasing physical activity can slow the progression of chronic kidney disease, namely through weight loss, lowering blood pressure, reducing oxidative stress and inflammation (Centers for Disease Control and Prevention., 2007; Stump, 2011). In people with diabetes, physical activity can slow the progression of CKD by reducing hyperglycaemia (Michishita et al., 2017). Good physical activity is recommended between 5-8 hours a day.

Non-compliance with taking medication results in worsening individual health status. Previous studies stated that non-compliance with taking medication, including people with hypertension, can cause blood pressure to become uncontrolled (Tesfaye et al., 2021). In this study, more subjects adhered to taking medication (71.3%) than those who did not comply. Subjects who disobey because they don't feel sick, drink herbal concoctions, and forget. Several studies state that non-adherence to treatment is also due to a lack of knowledge about the course of chronic kidney disease which is associated with treatment, as well as forgetfulness (Tesfaye et al., 2021).

In this study, psychological-stressful environments were shown to have an effect on the subjects' protein urine and health status. The more stress an individual has, the more likely they are to be at risk of chronic kidney disease. Many researchers from the field of psychology show how stress mechanisms lead to chronic kidney disease (Bruce et al., 2015a; Mankowski & Maton, 2010) Stress can have a negative impact on physical disorders directly through physiological effects and indirectly through behaviour and practices that impact health (Bruce et al., 2015b). If we look at the relationship between stress and pathophysiology, it can be related to blood pressure, heart rate and blood vessel reactivity (Rosmond, 2005). stress results in high activity of the sympathetic nervous system, increasing glucocorticoid secretion, and inflammatory cytokine levels. Where, the factors mentioned above lead to blood vessel diseases such as hypertension and diabetes mellitus. All of these diseases are the most important risk factors for chronic kidney disease.

Social characteristics such as ethnicity and social class trigger to stress. The mechanism of how stress causes chronic kidney disease can also be seen in how individuals negotiate structurally and face the cultural obstacles around them (Bruce et al., 2010; McLeod, 2012). This study did not show a significant influence between herbal consumption behaviour and genetic factors on chronic kidney disease in multivariate analysis. Most of the research subjects did not consume herbs (60.3%), because most of the subjects already suffered from chronic kidney disease. This is because chronic kidney sufferers are recommended not to drink herbal concoctions, except for medication from a doctor. In contrast to previous research, it was stated that regular use of Chinese herbal medicine without a prescription triggers chronic kidney disease (Hsieh et al., 2012).

The genetic factors also did not influence significantly to chronic kidney disease. This is because there were only 7.4% subjects who have a family history of kidney disease, including kidney stones, acute and chronic kidney disease. Diagnosis of inherited genetic factors for chronic kidney disease in adults is difficult to detect (Torra et al., 2021). This is due to atypical phenotypes, unavailability of universal genetic testing and lack of knowledge about the relationship between genotype and phenotype (Doreille et al., 2020). Besides that, the subject's ignorance of his family's medical history was due to the absence of a history of medical examinations on their parents or seniors.

Study limitations

Considering that chronic kidney disease is a silent killer disease, it is likely that there are still many sufferers who do not know early about their disease, and therefore they do not visit to health centres. Therefore, to generalize the results of this research, it still needs to be tested again by increasing the number of samples. However, the implication of the results of this study is that the results of the interpretation can be a reference for future researchers, as well as a basis for planning chronic kidney disease control programs.

CONCLUSION

This research has shown that there is a difference in early detection of chronic kidney disease between testing urine protein and creatinine levels and health status which is associated with behavioural factors, psychological-stress environment and genetics. Protein urine examination can be used to early detection to chronic kidney diseases which related to insufficient drinking water consumption, daily calorie intake and stressful psychological environment. However, this method cannot be related to herbal consumtion, physical activity, compliance medication and genetic factor. Meanwhile, the urine creatinine level test cannot be used for early detection of the risk of chronic kidney disease which is associated with behavioural factors, stressful psychological environments or genetic factors.

However, early detection related to an individual's health status can be done by linking daily drinking water consumption behaviour, physical activity, medication adherence, and the psychological-stress environment. However, this method cannot be used for early detection of chronic kidney disease when it is linked to individual behaviour such as daily calorie intake, herbal consumption and genetic factors.

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