Malnutrition Risk Among Chronic Kidney Disease Patients Attending the Nephrology Clinic in Hospital Tengku Ampuan Afzan, Pahang

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ABSTRACT

Objective: The prevalence of chronic kidney disease among adult in Malaysia has been increasing and it is forecasted that the pattern will remain. The risk for malnutrition is prominent especially in the later stage of chronic kidney disease. Early detection of malnutrition is important to prevent further complications. However, limited studies on malnutrition risk has been conducted in Malaysia. Therefore, this study was performed to determine the prevalence and associated risk factor of malnutrition among chronic kidney disease patient attending Nephrology Clinic in Hospital Tengku Ampuan Afzan, Kuantan, Pahang. **Methods:** A cross-sectional study was conducted among 70 chronic kidney disease patients using convenience sampling. All patients were explained about the study and informed consent obtained prior the administration of questionnaire. There were three parts of questionnaire to be answered which were on sociodemographic, clinical characteristic and dietary information along with Malnutrition Risk Screening Tool-Hospital to measure the risk for malnutrition. **Results:** Most of the participants were married (75.7%), had completed primary school (58.6%), currently not working (32.9%), had income between RM 1000 to RM 1999 (37.1%) and living with three or four members in a household (24.3%). Majority had at least one precipitating disease that causes chronic kidney disease such as hypertension (71.4%) followed by diabetes (61.4%) and high cholesterol (30.0%). Almost 21.4% of chronic kidney disease patients screened were at risk for malnutrition. Further inferential analysis shows an association between weight loss (p=0.001) towards risk for malnutrition. **Conclusion:** Overall, the risk for malnutrition among chronic kidney disease patient was fairly high. This warrant close attention of the healthcare professional that caring for the patients particularly in detection of detrimental weight loss during each follow up visit. A referral to the dietician is important to ensure the patients received adequate counselling and education on dietary management.

Keywords: Malnutrition Risk, Chronic Kidney Disease, Risk Factors

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INTRODUCTION

Chronic Kidney Disease (CKD) is an irreversible loss of renal functions for at least three months and poses a major public health problem (1–3). In Malaysia, the exact estimation of CKD is unknown. However, the prevalence of CKD in adult Malaysian population has increased from 9.07% in 2011 to 15.48% in 2018 (4). According to the study, the distribution of CKD stages are as follows: stage 1, 3.85%; stage 2, 4.82%; stage 3,

6.48% and stage 4-5, 0.33% (4).

Moreover, the 24th report of Malaysian dialysis and transplant registry stated the number of patients receive dialysis has increased from 26,373 in 2011 to 39,711 in 2016 (3). In fact, it is reported that 5.0% of the respondents diagnosed with CKD were not aware that they had CKD which may expose them to many complications including anaemia, protein energy wasting (PEW) and chronic pruritis (3,5,6). One of the common complications of CKD is risk for malnutrition which developed over time while living with the disease. Globally, the reported risk of malnutrition ranged between 7.0% to 61.8% (7–10). To date, there is no established population-based study has been conducted to determine the risk of malnutrition among Malaysian.

Malnutrition is defined as deficiencies, excesses or imbalances in a person's intake of energy and nutrients which can be categorized either undernutrition or overnutrition (11,12). The risk of malnutrition is further increased when the CKD progress to the late stage where it requires robust management including monitoring renal profile, prescribing suitable pharmacotherapy based on morbidities presented along with lifestyle modification such as weight monitoring, exercise, fluid restriction and smoking status. Furthermore, CKD is commonly associated with having multiple morbidities such as diabetes, hypertension, hypercholesterolemia, receiving of renal replacement therapy (RRT) which may affect someone dietary intake which may lead to risk of malnutrition (13,14). Other than that, sedentary lifestyle, having depression and lack of social support may aggravate the risk of malnutrition which leads to cachexia, protein energy wasting and inflammatory response if left untreated (13–19).

Little is known about the risk of malnutrition particularly among patients with early stage of CKD in Malaysian hospital or nephrology clinic settings. Malnutrition are reported to be a major issue in CKD where it affects morbidity, mortality, further progression of the current disease into end stage renal disease (ESRD) along other health problems (8,13,16,18–20). Moreover, routine screening on risk of malnutrition among CKD patients is seldom carried out at any nephrology clinic or hospital setting in Malaysia because patients are monitored based on their biochemical parameters such as urine dipstick and renal function test during the follow up session. A previous study did recommend that a valid, more practical and simpler tool must be used in order to determine the risk of malnutrition among CKD patient (13).

Thus, early detection of malnutrition should be performed to delay the progress of CKD from becoming worse (20). Apart of routine biochemical parameters monitoring, it is also recommended that a nutritional assessment including anthropometric measurements to be performed regularly in detecting risk of malnutrition. A simple and reliable tool would be beneficial for early identification and management of poor nutritional status in Malaysian CKD patients. In lieu to this, the current study was conducted to determine the prevalence and its associated factors of malnutrition risk among CKD patients attending the Nephrology Clinic at Hospital Tengku Ampuan Afzan (HTAA), Kuantan, Pahang.

METHODS

Population and setting

A cross-sectional study was conducted from March to June 2018 to determine the prevalence and its associated factors of malnutrition risk among 70 CKD patients attended Nephrology Clinic, HTAA, Kuantan Pahang. This study was approved by the Kulliyyah of Nursing Postgraduate and Research Committee (KNPGRC) along with Medical and Research Ethics Committee (MREC) with project identification of NMRR 18-561-40393 IIR.

Inclusion and exclusion criteria

The inclusion criterion in this study were: (1) aged 18 and above; (2) CKD stage 1 to 2 and (3) CKD patient with metabolic condition (history of diabetes mellitus, hypertension, hyperlipidemia, cardiovascular risk). Meanwhile, the exclusion criteria were (1) all CKD patients that had already started with dialysis or (2) prescribed with renal therapy treatment (RRT) and (3) non-Malaysian citizens. The sampling frame was obtained from the list of CKD patients attended the Nephrology Clinic at HTAA, Kuantan Pahang when the data collection taken place. The patients were conveniently selected to participate in this study during their follow up session on every Monday and Wednesday.

Research instrument

A set of questionnaires in Malay language was distributed to the patients as the research tool used in this study. The questionnaires were divided into three parts: (A) Sociodemographic information; (B) Clinical characteristics and dietary information and (C) Malnutrition Risk Screening Tool-Hospital

(MRST-H) which had been utilized among more than 500 geriatric patients was adopted to determine the risk of malnutrition among CKD patients (21,22). Prior the actual survey study, a pilot study was performed to determine the reliability since the instrument was first time used among patients with CKD.

The questionnaire for Part A consisted of items on age, race, occupational, educational level, smoking status and monthly income. Meanwhile, the items asked in Part B were about clinical characteristics such as history of past illness, current prescribed medication, smoking status, self-reported information on routine dietary information and appetite along with anthropometric measurements of weight and height using OMRON body composition monitor with scale (SN 20121001161F). The nature of questions asked in Part A and Part B were in the form of close-ended. The Part C was a screening tool to detect malnutrition that previously validated among 542 elderly patients (21,22). The re-evaluation version of MRST-H had area under the ROC curve values of 0.84 and 0.88 when validated against the subjective global assessment (SGA)-determined malnutrition (SGA B+C) and severe malnutrition (SGA C) status. These high area under curve (AUC) values indicated that the MRST-H has very good overall diagnostic accuracy in screening for risk of malnutrition in patients (21,22). There were five (5) items asked about the ability of the patient in buying food, to feed him/herself, history of weight loss in the last six months and anthropometric measurement (e.g. body mass index (BMI), mid upper arm circumference (MUAC) and calf circumference (CC). For Part C, if the total score was more than two, the patient was at high risk for malnutrition (21,22).

Pilot study

This phase was completed before proceeding to the actual study phase. One of the authors had undergone appropriate anthropometric training with the principal investigator cum main supervisor and another two clinical dietitians prior data collection to ensure accurate measurements were taken. There were 31 participants involved in this study with one participant was excluded due to under age (below 18 years). A cross-sectional study was performed among 30 CKD patients attended the Nephrology Clinic, HTAA to examine the validity and reliability of the questionnaires (Table 1). The questionnaires had gone through face validation with 30 patients in improving the arrangements and avoiding redundancy of items (23). The internal consistency of the questionnaires was tested using Cronbach's alpha (23). The value obtained for the pilot study is 0.59, having moderate to good reliability which the tool was considered as reliable to measure the risk of malnutrition among CKD patients (23,24).

Sample size and data collection procedure

The actual study was conducted at the same Nephrology Clinic, HTAA. However, different CKD patients were recruited that did not involve in the pilot study. The total CKD patients registered at the clinic annually was approximately 434. The sample size was calculated using sample size calculator, Raosoft (2004), with the margin error of 5%, confidence interval of 95% and response rate of 22% (25). After calculation, the minimum recommended sample size of this study was 165 participants and after added 10% attrition, the final sample size was 180. However, only 70 patients were achievable because of the limitations such as time constraint and willingness to participate. Nevertheless, this sample size was considered adequate for a new survey study. The range between 5 to 10% of a survey sampled from the actual population was considered acceptable (26). Brief explanation about the study was given to the CKD patients before handing the consent form and questionnaires. The time given to the patient to complete the questionnaire and anthropometric measurements was between 15 to 30 minutes.

Data analysis

IBM Statistical Package Social Science (SPSS) version 23.0 was used for data management and analysis. Frequency and percentage were used for analysing the categorical data. Meanwhile, mean and standard deviation were used to analyse the numerical data using descriptive statistics. A non-parametric testing, Pearson Chi Square analysis was used to determine the associated factors of risk for malnutrition for inferential statistics. The categories were re-coded to allow for such analysis. The level of significance was set at p-value less than 0.05.

RESULTS

Socio-demographic data

Overall, there were 70 CKD patients had involved in the study. Based on the results in Table 1, almost similar number of male and female CKD patients had participated with 52.9% were male. The mean age for the participants were 58.39 (±16.728) years old. Majority of the participants were Malays (75.7%) followed by Chinese (15.7%). More than half of the participants were married

(75.7%), had completed primary school (58.6%), currently not working (32.9%), had income between RM 1000 to RM 1999 (37.1%) and living with three or four members in a household (24.3%).

Table 1: Socio-demographic characteristics of the respondents (n=70)

Variables	Frequency (n)	Percentage (%)	Mean ± SD
Age			58.39 ±16.73
Gender			
Male	37	52.9	
Female	33	47.1	
Race			
Malay	53	75.7	
Chinese	11	15.7	
Indian	4	5.7	
Others	2	2.9	
Marital status			
Single	6	8.6	
Married	53	75.7	
Widower/widow	10	14.3	
Divorcee	1	1.4	
Education level			
Primary	41	58.6	
Secondary	17	24.3	
Certificate/diploma	8	11.4	
Degree/Master/PhD	4	5.7	
Working status			
Not working	23	32.9	
Government	6	8.6	
Private	2	2.9	
Self-employed	22	31.4	
Pensioner	17	24.3	
Income			
> RM5000	1	1.4	
RM4000-RM4999	1	1.4	
RM3000-RM3999	12	17.1	
RM2000-RM2999	15	21.4	
RM1000-RM1999	26	37.1	
RM700-RM999	13	18.6	
RM400-RM699	2	2.9	
Number of household			
2	16	22.9	
3	17	24.3	
4	17	24.3	
5	9	12.9	
6	8	11.4	
7	1	1.4	
8	1	1.4	
13	1	1.4	

Clinical characteristics and dietary information

Table 2 highlighted the results on clinical characteristics and dietary information of the CKD patients. Majority had at least one precipitating disease (44.3%) that causes CKD. Hypertension (HTN) was recorded the highest leading causes of chronic kidney disease (CKD) (71.4%), diabetes mellitus DM (61.4%) and high cholesterol (30.0%). About 87.1% patients were prescribed with medication to treat their diseases. Some of them claimed to remain smoking (12.9%) although having CKD and other morbidities. They had mean height (in centimetre) and weight (in kilogram) of 159±5.72 and 62.67±12.51 respective with mean BMI of 24.47±4.25 in kgm-2. Quite a number of patients reported having weight loss (32.9%) for last few months but the exact reasons were not further asked. The patients reported had taken two meals daily (52.9%) with preference for fried food (57.1%) and mean daily water intake of 6.71±1.86 glass/day including plain water (67.1%) and coffee/tea (28.6%). Some of them experienced loss of appetite (38.6%), difficulties in chewing and swallowing (1.4%) respectively. Other than that, only 32.9% of CKD patients claimed of having insufficient income for their daily spending.

Risk of malnutrition

Table 3 reported the items asked in the MRST-H. A total of 34.3% patients answered "Yes" for item 1 which they depend on someone for source of income to support their daily living cost. Next, 15.7% patients reported of having weight loss for the past one month or six months. A total of 7.1% of them recorded MUAC reading of less than 23 cm for male and less than 22 cm for female and the score of 2 were given. The total score was calculated for each of the patients. and it was observed that that 21.4% of the CKD patients were at risk for malnutrition.

Associated factors for risk of malnutrition

Results in Table 4 and Table 5 showed the association between socio-demographic background, clinical characteristics and dietary information towards the risk for malnutrition calculated using the MRST-H tool. Overall, there was no significant association between socio-demographic variables and risk of malnutrition. Only single variable was found significantly associated with risk of malnutrition which was weight loss (p=0.001).

Table 2: Clinical characteristics and dietary information of the respondents (n=70)

Variables	Frequency (n)	Percentage (%)	Mean ± SD
Number of illness			
0	1	1.4	
1	31	44.3	
2	21	30.0	
3	13	18.6	
4	4	5.7	
*Past and current illness			
Diabetes	43	61.4	
Hypertension	50	71.4	
High cholesterol	21	30.0	
Heart disease	9	12.9	
Stroke	2	2.9	
Kidney stone	3	4.3	
Current mediation			
Yes	61	87.1	
No	9	12.9	
Smoker			
Yes	9	12.9	
No	61	87.1	
Ex-smoker (≥ 5 years)			
Yes	27	38.6	
No	43	61.4	
Height (current)			159.00 ± 5.72
Weight (current)			62.67 ± 12.51
Body Mass Index (kgm^{-2})			24.47 ± 4.25
Weight loss			
Yes	23	32.9	
No	47	67.1	
Specific diet			
Yes	10	14.3	
No	60	67.1	
Meals per day			
Once	7	10.0	
Twice	37	52.9	
3 times	24	34.3	
> 3 times	2	2.9	

Note: *The item may have more than one answer.

Table 2: Clinical characteristics and dietary information of the respondents (n=70) cont.

Variables	Frequency (n)	Percentage (%)	Mean ± SD
Cooking method			
Fry	40	57.1	
Boil	14	20.0	
Steam	14	20.0	
Others	2	2.9	
Amount water drink daily			6.71 ±1.86
Type of drinks			
Plain water	47	67.1	
Juice	3	4.3	
Coffee/tea	20	28.6	
Loss of appetite			
Yes	27	38.6	
No	43	61.4	
Difficulty in chewing			
Yes	1	1.4	
No	69	98.6	
Difficulty in swallowing			
Yes	1	1.4	
No	69	98.6	
Enough income to buy food			
Yes	47	67.1	
No	23	32.9	

Note: *The item may have more than one answer.

Table 3: Descriptive findings on the risk for malnutrition among CKD patients using MRST-H (n=70)

Items	Frequency (n)	Percentage (%)
Do you depend on someone for your source of income?		
Yes	24	34.3
No	46	65.7
Are you unable to feed or eat by self? (Y=1, N=0)		
Yes	0	0
No	70	100.0
*Weight loss during last month or six months ago? (Y=3, N=0)		
Yes	11	15.7
No	59	84.3

Table 3: Descriptive findings on the risk for malnutrition among CKD patients using MRST-H (n=70) cont.

Items	Frequency (n)	Percentage (%)
#Mid upper arm circumference (MUAC) in cm? (Y=2, N=0)		
Yes	5	7.1
No	65	92.9
$Calf circumference (CC) in cm? (Y=1, N=0)		
Yes	0	0
No	70	100.0
%**Total score**		
Score ≥ 2	15	21.4
Score < 2	55	78.6

Note:
Y=Yes; N=No
* Lost weight ≥5% in a month or ≥10% in 6 month
# 0 = MUAC ≥ 23.0 (Male), 22.0 (Female); 2 = MUAC < 23.0 (Male), 22.0 (Female)
$ 0 = CC ≥ 30.1 (Male), 27.3 (Female); 1 = CC < 30.1 (Male), 27.3 (Female)
% Score ≥ 2: Risk for malnutrition; Score < 2: No risk for malnutrition

Table 4: Association between socio-demographic background of CKD patients and risk for malnutrition (n=70)

Variables	Malnutrition (≥ 2)	No malnutrition (< 2)	p-value
	Freq (%) (15)	Freq (%) (55)	
Age			0.492
Elderly (≥50)	13	41	
Non-elderly (<50)	2	14	
Gender			0.087
Male	5	32	
Female	10	23	
Race			0.497
Malay	10	43	
Non-Malay	5	12	
Marital status			0.171
Married	9	44	
Non-married	6	11	
Education level			1.000
Higher education	2	10	
Lower education	13	45	
Working status			0.801
Working	6	24	
Not working	9	31	
Income			1.000
≥ RM4,360	15	53	
< RM4,360	0	2	
Number of household			0.588
≥ 4 members	8	25	
< 4 members	7	30	

Table 5: Clinical characteristics and dietary information of the respondents (n=70)

Variables	Malnutrition (≥ 2)	No malnutrition (< 2)	p-value
	Freq (%) (15)	Freq (%) (55)	
Number of illness			0.095
≥ 2	11	27	
< 2	4	28	
Current medication			1.000
Yes	13	48	
No	2	7	
Smoker			1.000
Yes	2	7	
No	13	48	
Ex-smoker			
Yes	6	21	1.000
No	9	34	
Body Mass Index (kgm^{-2})			0.759
Normal	4	19	
Non-normal (under/overweight)	11	36	
Weight loss			**0.001**
Yes	13	10	
No	2	45	
Specific diet			0.437
Yes	12	48	
No	3	7	
Meals per day			0.121
≥ 3 times	3	23	
< 3 times	12	32	
Cooking method			0.737
Fry	8	32	
Non-Fry	7	23	
Type of drinks			1.000
Plain water	10	37	
Non plain water	5	18	
Loss of appetite			0.054
Yes	9	18	
No	6	37	
Difficulty in chewing			
Yes	1	0	0.214
No	14	55	
Difficulty in swallowing			1.000
Yes	0	1	
No	15	54	
Enough income			0.545
Yes	9	38	
No	6	17	

DISCUSSION

Malnutrition is a condition whereby the nutrient intake is insufficient to achieve the optimal daily requirement (either undernourished or over-nourished) (12). Several factors have contributed towards risk of malnutrition including an individual illness state, mechanical obstruction, drug-related side effects and aging factor (8–10,20,27). Any illness state, acute or chronic may aggravate malnutrition in response to infection, inflammation and trauma as currently experienced by the CKD patients (11,15,17,18,28). These conditions may alter the metabolism, appetite, absorption, or assimilation of nutrients to be utilized by the cells which leads to the risk of malnutrition (9,16,17). Meanwhile, presence of mechanical obstructions at the gastrointestinal tract may lead to reduce food intake since nausea, vomiting, pain or discomfort is induced by the food entry (9,16).

Most of our CKD patients recruited for the current study were male, elderly with mean age of 58.39 ± 16.73, Malays, married, completed primary school, currently not working, living on income between RM1000 to RM1999 with three or four members in a household. Living in a larger household size was considered an average comparison with the national indicator in 2016 (4.1 person/house) as reported by Department of Statistics Malaysia (29). However, having an income between RM1000 to RM1999 was considered lower than the national median income of RM5228 for Malaysia in 2016 possibly because they were no longer working and having lower education (29). Furthermore, researchers from Khazanah Research Institute (KRI) reported there was higher chance of those households with income level below than RM5000 to cut back on actual consumption of food despite spending more money on it (29). In contrary, for the richer households, the shifts were more lifestyle oriented from expenditure on food at home to take away food, and on cultural and entertainment services. Nevertheless, having higher household income did not reflect the ability to buy goods particularly in urban areas where the expenditure is higher (15,29). Thus, it can be concluded that being elderly, having lower education and insufficient financial support has placed them at risk for malnutrition as reported in many literatures (8–11,15–17,20,27,30–32)

In terms of clinical characteristics, most of our patients were diagnosed with multiple morbidities such as HTN, DM, high cholesterol, heart disease, stroke and kidney stone and prescribed with medication for treatment. Almost 30% of CKD patients developed the disease due to HTN and DM in which the CKD progressed parallel with the incline of blood pressure (11,15–19,33,34). Previous studies also reported that having HTN and high cholesterol further expose one towards the risk of malnutrition-inflammation by causing protein energy wasting (PEW) (11,15–19,33,34). Meanwhile, DM among CKD patients may cause impairments of glucose oxidation, defective suppression of endogenous glucose production, and abnormal insulin secretion that impact on the metabolic process (34). Having poor lifestyle pattern such as smoking and preferred for fried food were observed in the current study.

The CKD patients in our study had almost similar pattern of BMI with a study conducted at the nephrology clinic in India whereby they either fall in the normal or slight overweight BMI categories (15). In contrary, studies conducted in Bangladesh and Turkey had more patients with underweight and overweight (16,28). Perhaps, the geographical variations may explain this difference of BMI pattern across countries thus caution should be taken in generalizing the findings with the current study. While in the general population, a higher BMI is associated with an increased risk of cardiovascular disease, but in a CKD patient particularly those who had started dialysis, the effect of overweight or obesity is paradoxically in the opposite direction (15,16,28).

A higher BMI leading to an improved survival rate for the CKD patients (15). The protective effect of higher BMI against mortality is related to higher fat mass (FM) and lean body mass (LBM) which help to improve the clinical outcome in CKD patients especially those undergo RRT (8,16,18–20,35). Therefore, maintaining a normal BMI as showed by our current CKD patients is important apart of practicing healthy diet (8,15,19,20).

In regards to dietary information, 67.1% of CKD patients in the current study claimed had not received any specific diet therapy and 52.9% only taken their meals twice a day. This pattern is quite worrisome since some patients did claim they experienced loss of appetite (38.6%) and difficulty in chewing or swallowing (1.4%). The previous local research reported a significant association between poorer appetite rating and risk of malnutrition among advanced CKD patients (36). Other than that, our patients have good compliance towards fluid intake with a mean glass of 6.71 ± 1.86 daily and majority preferred plain water (67.1%). The recommended fluid intake for adults are between 6 to 8 glasses daily as recommended by the Malaysian Dietary Guidelines (37). Previous studies mentioned that

multifactorial factors affect one dietary intake including aging, side effects of certain medications on the gastrointestinal system and further poor dentition that causes difficulty in chewing and swallowing that may increase the risk of malnutrition among CKD patients (9–11,15–19,30,32). Therefore, frequent comprehensive dietary counselling by nephrologists, nurses and referral to dietitians is vital to assist the CKD patients to cope with their symptoms and dietary intake. Regular check up to dentist and otorhinolaryngology specialist may also be helpful if difficulty in chewing and swallowing occurs persistently.

Further anthropometric measurements highlighted that weight loss in last six months occurred in 15.7% of the CKD patients and 7.1% of them had MUAC less than the required range according to their gender but no abnormality in CC measurement. As discussed previously, MUAC, a substitute of LBM was associated with higher all-cause mortality in particularly among advanced CKD patients (8,10,19). Higher FM in both sexes and higher LBM in women appear to confer a protective effect which can be achieved by performing regular physical activity (8,10,19,35,38,39).

In the current study, the risk of malnutrition among CKD patients reported was 21.4% when screened using the MRST-H instrument (8). However, based on several studies reported globally and in Malaysia, the risk of malnutrition risk varies between 7-61.8% was associated with higher all-cause mortality in particularly among advanced CKD patients (8–10,15). As previously mentioned, there is no study performed at national-based to determine the prevalence of malnutrition among CKD patients which limits the findings at single centre setting. Furthermore, cautions needed since different tools were used to measure the risk of malnutrition which may contribute towards wide difference of malnutrition risk across the nation. It is expected that the CKD cases will be inclined in an alarming pattern in Malaysia (1,3,7). Thus, achieving an optimum dietary intake to reduce the risk of malnutrition among CKD patients is a challenge for the healthcare professionals.

Overall, results on the association between socio-demographic data, clinical characteristics and dietary intake yield only one variable significantly affects the risk of malnutrition which was weight loss ($p=0.001$). A study conducted in Bangladesh proven that weight loss and loss of appetite were common among CKD patients and may contributed towards malnutrition (16). Furthermore, polypharmacy among CKD may also interfere the efficacy of nutrient absorption through drug-food interaction which cause decrease in appetite and food intake due to feeling of nausea and vomiting (10,15–19).

All of the findings discussed previously highlighted the need for collaborative management between multidisciplinary healthcare professional (HCP) for the CKD patients and their family members to reduce the risk of malnutrition. Weighing the symptoms of CKD and ensuring adequate dietary intake is not an easy job. Therefore, routine patient education and anthropometric monitoring apart of monitor the biochemical parameter during each follow up shall be recorded properly by the HCP since it provides valuable information about the disease progress and nutritional status of the CKD patients.

CONCLUSION

The current prevalence of risk of malnutrition among CKD patients were alarming although it was only 21.4% when screened via MRST-H tool. Through this study, the current BMI shows a normal range but weight loss is significantly associated with the risk of malnutrition among CKD patients. Thus, taking into consideration CKD patient's specific problems, subjective complaints and needs may be helpful in early prevention of malnutrition by planning a proper dietary management. A referral to the dietician is also important to ensure the patients received adequate counselling and education on dietary management.

LIMITATION AND RECOMMENDATION

There are several limitations found in the current study. Firstly, the sample size of the population is limited to a single population whereby it only involved the patients attending the Nephrology Clinic, HTAA in Kuantan, Pahang. Furthermore, the response rate only yields a result of 39.0%. Thus, the findings cannot represent the whole population in the state of Pahang for generalizability. It is recommended that the current study to be replicated in several other nephrology clinic in other government hospital in Pahang to determine the risk of malnutrition in a larger scale.

Secondly, the data obtained using only self-reported questionnaires may lead to bias whereby over- or under- reporting of dietary information may occur. Although weight loss reported in this

study is found significantly associated with risk of malnutrition. However, the predisposing factors are not conclusive because it may due to the impact of the disease, medications, source of income or preference of food. Since malnutrition occurs in multifactorial ways, it is suggested future study may integrate self-reported questionnaire with other blood profile parameter such as blood urea serum electrolyte (BUSE), C-reactive protein (CRP), total cholesterol and other relevant biochemistry profile. This will help in understanding the pattern of malnutrition occurrence among the CKD patients better.

Thirdly, since this is only a cross-sectional survey, it limits the causal-effect relationship in confirming the risk of malnutrition. Nevertheless, it provides valuable information on the current risk of malnutrition in a single centre, Nephrology Clinic in HTAA, Kuantan, Pahang. Thus, future prospective cohort study shall be conducted to determine the factors significantly associated with the risk of malnutrition using regression model.

Furthermore, the authors would like to recommend that each Nephrology Clinic in Malaysia government hospital setting should have periodic nutrition screening, consisting of laboratory measures, body weight, food intake and repeated screening for malnutrition every six months. Furthermore, more specialized post such as renal dietitians and renal nurses should be proposed to facilitate other health care professionals into correctly classifying the CKD patients with poor nutritional status. Furthermore, preparing the CKD patients and family members for transition care into the community setting such as proper dietary management at home setting is also vital.

CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest in this study.

ACKNOWLEDGEMENT

The authors would like to thank the International Islamic University Malaysia (IIUM) for providing funding via the Research Incentive Grant Scheme (RIGS 16-143-0307). Our gratitude also goes to the team members of the RIGS, multidisciplinary healthcare professionals of IIUM Medical Center (IIUM MC) and Hospital Tengku Ampuan Afzan (HTAA), as well as the research staff at the Clinical Research Center (HTAA). Special thanks to Miss Lim Bee Chiu, Miss Nur Sabrina Che Soh and Asst. Prof. Dr. Wan Hasliza Wan Mamat for the statistical analysis consultations, to clinical dietician from Kulliyyah of Allied Health Sciences (KAHS) such as Madam Rosshaniszan Mohd Kamarul Zaman and Madam Wan Nazma Fazira Wan Yusoff for anthropometric training, Madam Juraziah Ya'acob, the clinical nurse instructor and Mohammad Syafiq Bin Mohamad Azizi, student from Kulliyyah of Nursing in assisting the anthropometric training session along to those who have directly or indirectly assisted us in this endeavour.

REFERENCES

1. American Kidney Fund. Kidney Failure (ESRD) Causes, Symptoms, & Treatments [Internet]. 2017. Available from: https://www.kidneyfund.org/kidney-disease/kidney-failure/
2. Ministry of Health Malaysia. Clinical Practice Guidelines - Management of Chronic Kidney Disease 2nd Edition. Clinical Practice Guideline. 2018. 42–82 p.
3. Malaysian Society of Nephrology. 24th Report of the Malaysian Dialysis & Transplant 2016. [Internet]. 2016;263. Available from: https://www.msn.org.my/msn/Doc/PublicDoc_PB/Publication/mdtr2016/AllChapters.pdf
4. Saminathan TA, Hooi LS, Mohd Yusoff MF, Ong LM, Bavanandan S, Rodzlan Hasani WS, et al. Prevalence of chronic kidney disease and its associated factors in Malaysia; Findings from a nationwide population-based cross-sectional study. BMC Nephrol. 2020;21(1):1–11.
5. Rehman IU, Khan TM. Epidemiology of Chronic Kidney Diseases (CKD) in Malaysia and Pakistan, Pathophysiology of CKD-Associated Pruritus and Other CKD-Associated Dermatological Disorders. Prog Microbes Mol Biol. 2020;3(1):1–8.
6. Salman M, Khan AH, Adnan AS, Sulaiman SAS, Hussain K, Shehzadi N, et al. Prevalence and management of anemia in pre-dialysis Malaysian patients: A hospital-based study. Rev Assoc Med Bras. 2016;62(8):742–7.
7. Bujang MA, Adnan TH, Hashim NH, Mohan K, Kim Liong A, Ahmad G, et al. Forecasting the Incidence and Prevalence of Patients with End-Stage Renal Disease in Malaysia up to the Year 2040. Int J Nephrol. 2017;2017.
8. Chung S, Koh ES, Shin SJ, Park CW. Malnutrition in patients with chronic

kidney disease. Open J Intern Med. 2012;02 (02):89–99.
9. Norman K, Pichard C, Lochs H, Pirlich M. Prognostic impact of disease-related malnutrition. Clin Nutr. 2008;27(1):5–15.
10. Tayyem RF, Mrayyan MT. Assessing the Prevalence of Malnutrition in Chronic Kidney Disease Patients in Jordan. J Ren Nutr. 2008;18(2):202–9.
11. Zha Y, Qian Q. Protein nutrition and malnutrition in CKD and ESRD. Nutrients. 2017;9(3):1–19.
12. World Health Organization. What is malnutrition? [Internet]. 2016. Available from: http://www.who.int/features/qa/malnutrition/en
13. Harvinder GS, Swee WCS, Karupaiah T, Sahathevan S, Chinna K, Ahmad G, et al. Dialysis malnutrition and malnutrition inflammation scores: Screening tools for prediction of dialysis - related protein-energy wasting in Malaysia. Asia Pac J Clin Nutr. 2016;25(1):26–33.
14. Ikizler TA. A patient with CKD and poor nutritional status. Clin J Am Soc Nephrol. 2013;8(12):2174–82.
15. Jagadeswaran D, Indhumathi E, Hemamalini AJ, Sivakumar V, Soundararajan P, Jayakumar M. Inflammation and nutritional status assessment by malnutrition inflammation score and its outcome in pre-dialysis chronic kidney disease patients. Clin Nutr. 2019;38(1):341–7. Available from: https://doi.org/10.1016/j.clnu.2018.01.001
16. Reza HM, Shuvo S Das, Ahmad T. Assessing the prevalence of malnutrition in chronic kidney disease patients undergoing hemodialysis in Kushtia District, Bangladesh. Nutr Food Sci. 2018;48(1):150–64.
17. Iorember FM. Malnutrition in chronic kidney disease. Front Pediatr. 2018;6(June).
18. Peev V, Nayer A, Contreras G. Dyslipidemia, malnutrition, inflammation, cardiovascular disease and mortality in chronic kidney disease. Curr Opin Lipidol. 2014;25(1):54–60.
19. Bonanni A, Mannucci I, Verzola D, Sofia A, Saffioti S, Gianetta E, et al. Protein-energy wasting and mortality in chronic kidney disease. Int J Environ Res Public Health. 2011;8(5):1631–54.
20. Ortiz A, Covic A, Fliser D, Fouque D, Goldsmith D, Kanbay M, et al. Epidemiology, contributors to, and clinical trials of mortality risk in chronic kidney failure. Lancet. 2014;383(9931):1831–43.
21. Lin TS, Harith S, Abdullah H, Yusuf WNW. Re-Evaluation of Malnutrition Risk Screening Tool-Hospital (MRST-H) for Geriatric Patients: A Multicentre Study in Peninsular Malaysia (Penilaian Semula Alat Penyaringan Risiko Malpemakanan Hospital (MRST-H) untuk Pesakit Geriatrik: Kajian Pelbagai Pusat . Sains Malaysiana. 2016;45(9):1311–7.
22. Sakinah H, Suzana S, Noor Aini MY, Philip Poi JH, Shahrul Bahyah K. Development of a local malnutrition risk screening tool-hospital (MRST-H) for hospitalised elderly patients. Malays J Nutr. 2012;18(2):131–47.
23. DeVon H, Block M, Wright P, Ernst D, Hayden S, Lazzara D, et al. A Psychometric Toolbox for Testing Validity and Reliability. J Nurs Scholarsh. 2007 Feb 1;39:155–64.
24. Nyi Nyi Naing. Correlation and Regression. In: Intensive Course on "Basic Statistics and Research Methodology. Kubang Kerian: School of Medicine, Universiti Sains Malaysia, Kelantan, Malaysia; 2012.
25. Raosoft. Sample Size Calculator [Internet]. 2019. Available from: http://www.raosoft.com/samplesize.html.
26. John Arul Phillips. Statistics in Education (ESE 633). School of Education and Cognitive Science. Asia e University, Kuala Lumpur, Malaysia. 2009.
27. Kuhlmann MK, Kribben A, Wittwer M, Hörl WH. OPTA-malnutrition in chronic renal failure. Nephrol Dial Transplant. 2007;22(SUPPL.3):13–9.
28. Mutluay R, Konca Değertekin C, Işiktaş Sayilar E, Derici Ü, Gültekin S, Gönen S, et al. Serum fetuin-a is associated with the components of miac (Malnutrition, inflammation, atherosclerosis, calcification) syndrome in different stof chronic kidney disease. Turkish J Med Sci. 2019;49(1):327–35.
29. Khazanah Research Institute. The State of Households. 2014. 1–68 p.
30. Adejumo OA, Okaka EI. Malnutrition in pre-dialysis chronic kidney disease patients in a teaching hospital in Southern Nigeria. Afr Health Sci. 2016;16(1):234–41.
31. Amarya S, Singh K, Sabharwal M. Changes during aging and their association with malnutrition. J Clin Gerontol Geriatr [Internet]. 2015;6(3):78–84. Available from: https://www.sciencedirect.com/science/article/pii/S2210833515000672
32. Sevmez H, Bankoğlu Güngör M, Yeter H, Erten Y, Elbeg Ş, Yılmaz H. The

relationship among denture status, remaining teeth number, and malnutrition in patients with chronic kidney disease. Ther Apher Dial. 2019 Aug 5;24.
33. Judd E, Calhoun DA. Management of Hypertension in CKD: Beyond the Guidelines. Adv Chronic Kidney Dis. 2015;22(2):116–22.
34. Kerri L. Cavanaugh. Diabetes Management Issues for Patients With Chronic Kidney Disease. Clin Diabetes. 2007;25(3):90–7.
35. Heng AE, Cano NJM. A general overview of malnutrition in normal kidney function and in chronic kidney disease. NDT Plus. 2010;3(2):118–24.
36. Sahathevan S, Se CH, See HN, Chinna K, Harvinder GS, Chee WSS, et al. Assessing protein energy wasting in a Malaysian haemodialysis population using self-reported appetite rating: a cross-sectional study. BMC Nephrol. 2015;16(1):1–12.
37. Malaysian Dietary Guidelines. Key Message 11: Drink plenty of water daily [Internet]. 2010. Available from: https://www.moh.gov.my/index.php/pages/view/227
38. Cupisti A, D'Alessandro C, Finato V, Del Corso C, Catania B, Caselli GM, et al. Assessment of physical activity, capacity and nutritional status in elderly peritoneal dialysis patients. BMC Nephrol. 2017;18 (1):1–8.
39. Nazar CMJ. Significance of diet in chronic kidney disease. J nephropharmacology [Internet]. 2013;2(2):37–43. Available from: http://www.ncbi.nlm.nih.gov/pubmed/28197445%0Ahttp://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=PMC5297553